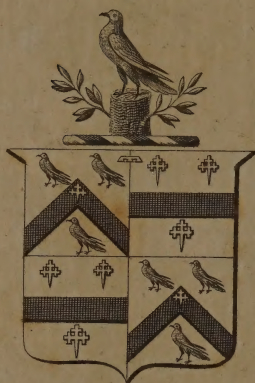


16067/B



N. Hadley Junr.



John Marmaduke Teesdale



NATURAL HISTORY

OF

BIRDS, FISH,

INSECTS, AND REPTILES.

EMBELLISHED WITH

UPWARDS OF TWO HUNDRED ENGRAVINGS.

IN SIX VOLUMES.

VOL. IV.

London:

PRINTED FOR THE PROPRIETOR,
AND SOLD BY H. D. SYMONDS, PATERNOSTER-ROW.

1808.

NATURAL HISTORY

OF

BIRDS, FISH,

INSECTS, AND REPTILES.

ILLUSTRATED BY



BY TWO VOLUMES

BY TWO VOLUMES

VOL. IV

C. SQUIRE, Printer,
Furnival's-Inn-Court, Holborn.

PRINTED FOR THE PROPRIETOR

BY H. D. STOKES, PATENT-PRINTERS

1897

CONTENTS

OF THE

FOURTH VOLUME.

	Page
<i>The Cachalot Physeter, or Spermaceti</i>	
<i>Whale, and its Varieties</i>	1
— <i>Dolphin, Porpesse, Grampus, and</i>	
<i>their Varieties</i>	17
— <i>Grampus</i>	24
— <i>Beluga of the Sea</i>	25
<i>Of Cartilaginous Fish in general</i>	26
<i>Of the Shark and its Affinities</i>	33
<i>The Blue Shark</i>	40
— <i>Balance Fish</i>	41
— <i>Saw ditto</i>	ibid
— <i>Sturgeon</i>	43
<i>The Thornback</i>	54
— <i>Rough Ray</i>	55
— <i>Sharp-nosed Ray</i>	ibid
— <i>Scate</i>	ibid
— <i>Fire Flare</i>	56
— <i>Torpedo</i>	63
<i>Lamprey</i>	75

	Page
<i>The Sea Orb</i> - - -	82
— <i>Lentriscus</i> - - -	83
— <i>Ostracion Cornutus</i> - - -	ibid
— <i>Five spined Coney Fish</i> - - -	ibid
— <i>Old Wife</i> - - -	84
— <i>Balistes</i> - - -	87
— <i>Unicorn Fish</i> - - -	ibid
— <i>Long Flie ditto</i> - - -	88
— <i>Sea Horse</i> - - -	89
— <i>Pipe Fish</i> - - -	91
— <i>Sucker</i> - - -	92
— <i>Lumpus, or Lump Fish</i> - - -	ibid
— <i>Lesser Sucking ditto</i> - - -	94
— <i>Liparis</i> - - -	ibid
— <i>Sun Fish</i> - - -	95
— <i>Fishing Frog</i> - - -	ibid
— <i>Armour Fish</i> - - -	97
— <i>Viper Mouth</i> - - -	99
— <i>Galley Fish</i> - - -	101
— <i>Ink ditto</i> - - -	103
— <i>Boney, or Spinous ditto</i> - - -	104
— <i>Prickly-finned ditto</i> - - -	
— <i>Trichurus</i> - - -	120
— <i>Sword Fish</i> - - -	121
— <i>Dorada, or Gilt-head</i> - - -	ibid
— <i>Uranoscopus</i> - - -	122
— <i>Dragonet</i> - - -	ibid

	Page
<i>The Blenneous, or Blenny</i>	122
<i>Gudgeon</i>	ibid
<i>Razor Fish</i>	123
<i>Mackarel</i>	ibid
<i>Wrasse</i>	ibid
<i>Sea Bream</i>	ibid
<i>Cat Fish</i>	124
<i>Perch</i>	ibid
<i>Father-lasher</i>	ibid
<i>Surmulet</i>	ibid
<i>Gurnard</i>	ibid
<i>Bullhead</i>	125
<i>Doree</i>	ibid
<i>Sabre</i>	ibid
<i>Strickleback</i>	ibid
<i>Sheat Fish</i>	ibid
<i>Mullet</i>	126
<i>Polynemus</i>	ibid
<i>Sea Serpent</i>	ibid
<i>Soft-finned Fish</i>	127
<i>Eeel</i>	ibid
<i>Gymnotus, or Carapo</i>	ibid
<i>Wolf Fish</i>	ibid
<i>Ammodytes</i>	ibid
<i>Lepadogaster</i>	128
<i>Cod Fish</i>	ibid
<i>Sucking ditto</i>	ibid

	Page
<i>The Garter Fish</i>	128
— <i>Loricaria</i>	129
— <i>Sword Fish</i>	133
— <i>Dorada</i>	135
— <i>Sea Wolf</i>	136
— <i>Cat Fish</i>	140
— <i>Salmon</i>	144
— <i>Capelar</i>	151
— <i>Tunny</i>	153
— <i>Cod</i>	157
— <i>Haddock</i>	159
— <i>Whiting</i>	ibid
— <i>Herring</i>	160
— <i>Sprat</i>	ibid
— <i>Shad</i>	165
— <i>Anchovy</i>	167
— <i>Sinensis</i>	168
— <i>Carp</i>	169
<i>Gold and Silver Fish</i>	176
<i>The Barbel</i>	182
— <i>Tench</i>	183
— <i>Chub</i>	185
— <i>Bleak</i>	186
— <i>Gudgeon</i>	187
— <i>Coryphæsea</i>	189
— <i>Blue Fish</i>	190
— <i>Parrot ditto</i>	ibid

	Page
<i>The Flying Fish</i> - -	191
— <i>Slender Flying ditto</i> -	194
— <i>Kite ditto</i> - -	ibid
— <i>Sucking ditto</i> - -	197
— <i>Eel</i> - -	199
— <i>Sand Eel</i> - -	200
— <i>Pike</i> - -	201
— <i>Mackarel</i> - -	205
— <i>Gurnet</i> - -	206
— <i>Greyling, or Umber</i> -	207
— <i>Loach</i> - -	208
— <i>Smelt</i> - -	209
— <i>Perch</i> - -	210
— <i>Mullet</i> - -	211
— <i>Blenny</i> - -	ibid
— <i>Crab, Lobster, and their Affinities</i>	212
— <i>Common Lobster</i> - -	214
— <i>Plated ditto</i> - -	219
<i>Craw Fish</i> - -	ibid
— <i>Prawn</i> - -	222
— <i>Shrimp</i> - -	ibid
— <i>White ditto</i> - -	ibid
— <i>Avosa Lobster</i> - -	223
— <i>Flea ditto</i> - -	ibid
— <i>Locust ditto</i> - -	ibid
— <i>Soldier Crab</i> - -	224
— <i>Sand ditto</i> - -	226

	Page
<i>The Mottled Crab</i>	226
— <i>Rough-shelled ditto</i>	227
— <i>Red-claw ditto</i>	228
— <i>Pea ditto</i>	ibid
— <i>Common ditto</i>	ibid
— <i>Black-claw ditto</i>	229
— <i>Velvet ditto</i>	ibid
— <i>Horrid ditto</i>	ibid
— <i>Land ditto</i>	230
<i>Amphibious Animals</i>	240
<i>The Turtle and Tortoise</i>	253
— <i>Land Tortoise</i>	255
— <i>African ditto</i>	259
— <i>Green Turtle</i>	265
— <i>Soft-shelled ditto</i>	266
— <i>Tuberculated ditto</i>	267
— <i>Crocodile</i>	275
<i>Testaceous Fish</i>	284
— <i>Garden Snail</i>	291
— <i>Water ditto</i>	297
— <i>Trochus</i>	300
— <i>Nautilus</i>	302
<i>Bivalved Shell-fish</i>	307
<i>The Muscle</i>	308
— <i>Oyster</i>	313
— <i>Scallop and Cockle</i>	317
— <i>Pivot</i>	ibid

NATURAL HISTORY

OF

BIRDS, FISH, REPTILES, &c.

THE CACHALOT, PHYSETER, OR SPERMACEŒ
WHALE, AND ITS VARIETIES.

ONE of the leading characteristics of this genus, is a number of teeth in the under jaw, but none in the upper. It is by no means of such an enormous size as the common whale. The tongue is small, but the throat, in contradistinction to the former tribe, is amazingly capacious, so that at one gulph it can swallow shoals of the smaller fish; its gullet is so enormous that it has been described as capacious enough to admit an ox. Loads of fish, some eight or nine feet in length, have been found undigested in its stomach; it is therefore as destructive as the whale is harmless. The

VOL. IV. B head

2 NATURAL HISTORY

head of the whale is nearly one third the size of the body; but the head of the cachalot constitutes one half of the animal. More slender than the former, it is also more active, and proportionably depredatory. This creature received its present technical name from Mr. Pennant, who enumerates seven different species:

1. The cachalot, with two fins and a black back;
2. The cachalot, with two fins and a whitish back;
3. That with a spout in the neck;
4. That with a spout in the snout;
5. That with three fins and sharp pointed teeth;
6. That with three fins and sharp-edged teeth; and
7. The cachalot, with three fins and flat teeth.

The cachalot race yields a smaller quantity of oil than the preceding genus, which, however, is amply atoned for by its affording so abundantly those two valuable articles, spermaceti and ambergris.

The ignorance of the people who first used spermaceti, gave it a name which seemed to express

express its being the semen of the whale; but it is, in reality, no more than a preparation of the oil with which that fish abounds.

It is a fine, bright, white, and semi-pellucid substance, formed into oblong flakes very light, soft, and unctuous to the touch, inflammable, soluble in oil, but not in watery menstrua; of scarcely any smell when fresh and fine, and of a soft, agreeable, and unctuous taste. The largest, firmest, and whitest flakes of it should be chosen. It is liable to become rancid and yellowish in keeping; and the smaller fragments contract this bad quality sooner than the larger.

The first knowledge that the world seems to have had of spermaceti, was the finding it swimming on the surface of the water in the northern seas: and it is not surprising that people who knew no more of its origin than what they were informed of by those who found it so floating on the sea, referred it to the mineral class, supposing it to be bitumen formed in the bowels of the earth, and thrown up from the bottom of the ocean, as was the opinion of Schroder, and others of his time. It was discovered soon after, however, that the head of a peculiar species of whale, afforded a fatty substance, which, when boiled, and pro-

perly prepared, was analagous to this. And hence it was soon deduced, that the masses of it first found on the water, were of the same origin; that they had been formerly an oily matter in this fish, which, getting loose, on the decay of the dead carcase, or by any other means, had been washed and bleached by the salt water, and the sun, into the form in which it was then found. The opinion of its being the sperm, or semen, of the whale, was as early almost as its first discovery, and seems to have been formed merely on account of its whiteness.

The spermaceti of the shops was made first from the head of this fish; the oil obtained from its brain, and the diploe of the cranium, furnishing all that we had of it; and hence the considerable price it was then kept at. It was some time after found out, however, that any whale oil would do as well as this, which occasioned the price to fall considerably. At present it is made in England from whale oil of any kind, the settling of our oilmen's large vessels, particularly, which are boiled with a quantum of German pot-ash, or pearl-ashes, till white and firm; and after several other meltings, and a thorough separation of what saline particles might have got into the matter,
it

it is, when cold, cut out with knives into the flakes we see it in. The process is easy, but it requires care, and nice inspection towards the end: if not enough boiled, it is apt to turn yellow, and soon grows rancid.

Spermaceti is, therefore, oil of the animal kind, rendered very sweet, and fit for internal use. Its virtues are emollient and pectoral; it is good in coughs, and other disorders of the breast; and excellent in internal applications,* such as liniments and the like; it readily dissolves in oil, or other fatty substances, for the latter purposes; and for the former, it blends with the yolk of an egg, and after that mixes with an aqueous fluid, and makes a pleasant emulsion.

But the spermaceti, as naturally formed, is undoubtedly the brain of the animal. A thick covering of fat lies immediately under the skin of the head; beneath this fat, there is another thick skin, which instead of a bony skull, serves for the covering and defence of the animal's brain. The first cavity of the brain is filled with that spermaceti which is supposed

* Thus Shakspeare's fop told Hotspur,

—————"That spermaceti

Was the sovereign'st thing on earth

For an inward bruise."

Henry IV.

supposed to be of the greatest purity and highest value. Seven barrels of the clearest spermaceti is generally the produce of this cavity, which when thrown upon water, coagulates like cheese. There is also another chamber or cavity, just over the gullet, about seven feet high, that affords a considerable quantity, though of less value than the first. It is observable, that in proportion as the oily substance is drawn from this part, it fills again from every part of the body. The spinal marrow also affords no inconsiderable quantity. This substance has become not more an article of manufacture than a medicine; for candles, cheaper though not less elegant than wax, are plentifully made of it.

Ambergris, which is now also known to be the production of the cachalot whale, is a solid, opake, ash-coloured, fatty, inflammable substance, variegated like marble, remarkably light, rugged, and uneven in its surface, and has a fragrant odour when heated.

It is found swimming upon the sea, or on the sea coast, or in the sand near the sea coast; especially in the Atlantic Ocean, on the coast of Brasil, and that of Madagascar; on the coast of Africa, of the East Indies, China, Japan, and Molucco islands; but most of the
ambergris

ambergris which is brought to England comes from the Bahama islands, from Providence, &c. where it is found on the coast. It is also sometimes found in the abdomen of whales by the whale fishermen, always in lumps of various shapes and sizes, weighing from half an ounce to a hundred or more pounds. The piece which the Dutch East India company brought from the King of Tydor, weighed 182 pounds. An American fisherman from Antigua found, some years ago, about 52 leagues south-east from the Windward Islands, a piece of ambergrise in a whale, which weighed about 130 pounds, and sold for 500l. sterling.

The most satisfactory account of the real origin of ambergris, is that given by Dr. Sweddiar, in the 73d volume of the Philosophical Transactions, art. 15. According to the best information he could obtain from several of the most intelligent persons employed in the spermaceti whale-fishery, and in procuring and selling ambergris, it appears, that this substance is sometimes found in the belly of the whale, but in a particular species only, which is called the *spermaceti whale*.

The New England fishermen, according to their account, have long known that ambergris is to be found in the spermaceti whale,
and

and they are so convinced of this fact, that, whenever they hear of a place where ambergris is found, they always conclude that the seas in that part are frequented by this species of whale.

The persons who are employed in the spermaceti whale fishery, confine their views to the great headed whale, or *macrocephalus*. Whenever they hook a spermaceti whale, they observe, that it not only constantly vomits whatever it has in its stomach, but also commonly discharges its fæces at the same time, and if the latter circumstance take place, they are generally disappointed in finding ambergris in its belly. But whenever they discover a spermaceti whale, male or female, which seems torpid and sickly, they are always pretty sure to find ambergris, as in this state it seldom voids its fæces upon being hooked. They likewise meet with it in the dead spermaceti whales, which they sometimes find floating on the sea. It is observed also, that the whale, in which they find ambergris, often has a morbid protuberance, or, as they express it, a kind of gathering in the lower part of its belly, in which, if cut open, ambergris is found. It is observed, that all those whales, in whose bowels ambergris is found, seem not
only

torpid and sick, but are also constantly leaner than others; so that if we may judge from the constant union of these two circumstances, it would seem that a larger collection of ambergris in the belly of the whale is a source of disease, and probably sometimes the cause of its death. As soon as they hook a whale of this description, torpid, sickly, emaciated, or one that does not dung on being hooked, they immediately either cut up the above-mentioned protuberance, if there be any, or they rip open its bowels from the orifice of the anus, and find the ambergris sometimes in one, sometimes in different lumps; generally from six to twelve and more inches in diameter, and from one pound to twenty or thirty in weight, at the distance of two, but more frequently of about six or seven feet from the anus, and never higher up in the intestinal canal, which, according to their description, is, in all probability, the *intestinum cæcum*, hitherto mistaken for a peculiar bag made by nature for the secretion and collection of this singular substance. That the part they cut open to obtain the ambergris is no higher than the intestinal canal is certain, because they constantly begin their incision at the anus, and find the cavity every where filled

up with the fæces of the whale, which from their colour and smell it is impossible for them to mistake. The ambergris found in the intestinal canal is not so hard as that which is found on the sea or sea-coast, but soon grows hard in the air; when first taken out, it has nearly the same colour, and the same disagreeable smell, though not so strong as the more liquid dung of the whale has; but on exposing it to the air, it not only by degrees grows greyish, but it also loses its disagreeable smell, and when kept for a certain length of time, acquires the peculiar odour which is so agreeable to most people.

The gentlemen that Dr. Swedjar conversed with confessed, that if they knew not from experience that ambergris thus found will in time acquire the above-mentioned qualities, they would by no means be able to distinguish ambergris from hard indurated fæces. This is so true, that whenever a whale voids its fæces upon being hooked, they look carefully to see if they cannot discover in the more liquid excrements (of which the whale discharges several barrels), some pieces floating on the sea, of a more compact substance than

the

the rest; these they take up and wash, knowing them to be ambergris.

All ambergris, when taken out of whales, has nearly the same smell as the liquid excrements of the animal, and also the same blackish colour: and it is a fact, that after being taken out and kept in the air, it grows not only harder and whiter, but also loses, by degrees, its smell, and assumes such an agreeable one, as that in general has which is found swimming upon the sea; the goodness, therefore, of ambergris seems to depend much upon its age; and the only reason why ambergris found floating on the sea is of better quality, is its greater age and longer exposure to the air. It is more frequently found in males than females—the pieces in the latter being generally smaller, and the quality inferior.

It is well known that the *sepia octopodia*, or cuttle-fish, is the constant and natural food of the spermaceti whale, or *physeter macrocephalus*. Of this the fishers are so well persuaded, that whenever they discover any recent relics of it swimming on the sea, they conclude that a whale of this kind is, or has been, in that part. Another circumstance which corroborates the fact is, that the sper-

maceti whale, on being hooked, generally vomits up some remains of the *sepia*. Hence it is easy to account for the many beaks or pieces of beaks, of the *sepia* found in all ambergris. The beak of the *sepia* is a black horny substance, and therefore passes undigested through the stomach into the intestinal canal, where it is mixed with the fæces; after which, it is either evacuated with them, or if these latter be preternaturally retained, forms concretions with them, which render the animal sick and torpid, and produce an obstipation, which ends either in an abscess of the abdomen, as has been frequently observed, or becomes fatal to the animal; whence in both cases, on the bursting of its belly, that hardened substance, known by the name of *ambergris*, is found swimming on the sea, or thrown upon the sea coast.

From the preceding account, and his having constantly found the above-mentioned beaks of the *sepia* in all pieces of ambergris of any considerable size, Dr. Swedjar concludes, with great probability, that all ambergris is generated in the bowels of the *Physeter macrocephalus*, or spermaceti whale, and there mixed with the beaks of the *sepia* octopodia, which is the principal food of that whale. He therefore

therefore defines ambergris to be the *preternaturally hardened dung, or fæces, of the physeter macrocephalus, mixed with some indigestible relics of its food.*

The use of ambergris in Europe is now nearly confined to perfumery, though it was formerly recommended in medicine by many eminent physicians, yet perhaps in quantities too small to produce any sensible effect.

In Asia and part of Africa, ambergris is not only used as a medicine, and as a perfume, but considerable use is also made of it in cookery, by adding it to several dishes as a spice.

By the pilgrims who frequent Mecca, it is used in fumigations, in the same manner as frankincense is used in Catholic countries. The Turks made use of it as an aphrodisiac; and among the English perfumers it is applied to a variety of purposes.

One thing is very remarkable; that this drug, which is the most sweet of all the perfumes, should be capable of being imitated in smell, by a preparation of the most odious of all stinks. Mr. Hornbey found, that a vessel in which he had made a long digestion of the human fæces acquired a very strong and perfect smell of ambergris, insomuch that
any

any one would have thought a great quantity of essence of ambergris had been made in it. The perfume was so strong and offensive, that the vessel was obliged to be removed out of the laboratory.

To view these animals in a commercial light, we must observe, that the English were so late as the year 1755 before they engaged in the whale fishery. This appears strange; for by the account Ochter gives of his travels to King Alfred, almost seven hundred years before that period (in Hackluyt's collection of voyages), it is evident that he made that monarch acquainted with the Norwegians practising the whale fishery; but it seems all memory of that gainful employ, as well as of that able voyager Ochter, and all his important discoveries in the North, were lost for nearly seven centuries.

It was carried on by the Biscayeneers long before we attempted the trade; and that for the sake, not only of the oil, but also of the whalebone, which they seem to have long trafficked in. The earliest notice we find of that article in our trade is by Hackluyt, who says it was brought from the Bay of St. Lawrence by an English ship that went there for the *barbes* and *fynnes* of whales and train oil,

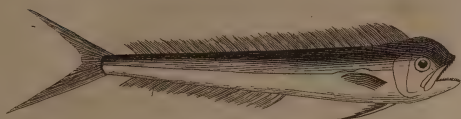
oil, 1594, and who found there seven or eight hundred whale *fynnes*, part of the cargo of two great Biscayer ships, that had been wrecked there three years before. Previously to that, the ladies' stays must have been made of split cane, or some tough wood, as Mr. Anderson observes, in his dictionary of commerce; it being certain that the whale fishery was carried on for the sake of the oil, long before the discovery of the use of whalebone.

The great resort of these animals was found to be on the inhospitable shores of Spitzbergen; and the European ships made that place the principal fishery, which for numbers of years was very successful: the English commenced that business about the year 1598, and the town of Hull had the honour of first attempting that profitable branch of trade. At present it seems to be on the decline, the quantity of fish being greatly reduced by the constant capture for such a vast length of time: some recent accounts, indeed, inform us, that the fishermen, from a defect of whales, apply themselves to seal-fishing, from which animals they extract oil. This, too, it is apprehended will not be of long continuance; for these shy and timid creatures will soon be induced

duced to quit those shores, by being perpetually harrassed, as the morse or walrus has already done. It is also said, that the poor natives of Greenland begin even now to suffer from the decrease of the seal in their seas—it being their principal subsistence, so that should it totally desert the coast, that miserable country would be in danger of perishing through want.

In former times, it appears that the whale was never taken on our coasts, except when it was accidentally thrown ashore: it was then deemed a royal fish, and the King and Queen divided the spoil;—the King asserted his right to the head, and her Majesty to the tail.

The art of taking whales is not only so generally known as to exclude it from a share of this work, but is indeed foreign to the design. The fishery begins in May, and generally concludes with the end of August. The methods of catching have been improved by time, and the use of the harpoon has given way to machines more powerful and more certain. Better modes have been discovered for extracting the oil, and better instruments for cutting up the animal, than were used in the early fisheries. To some nations, the flesh of the whale is a dainty; the French seamen now and then



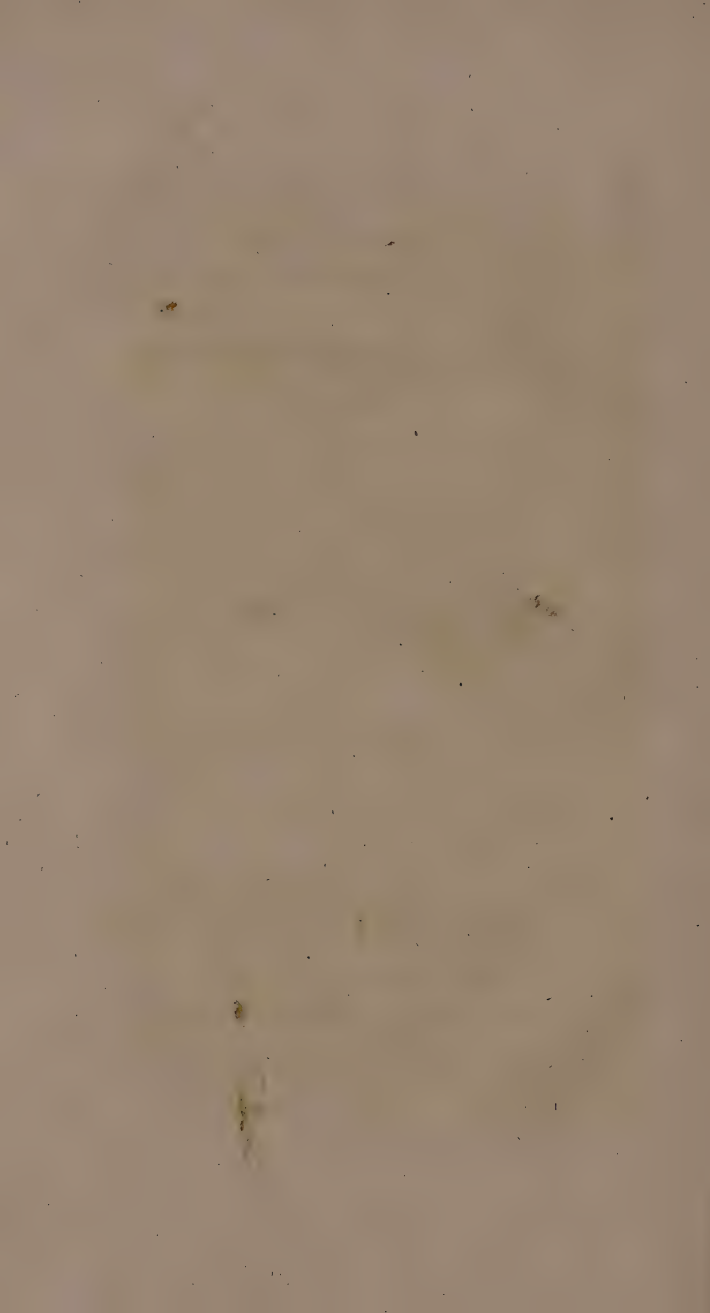
Dolphin.



Balance Fish.



Shark.



then dress it for their diet at sea, and the natives of Greenland, as well as the savage inhabitants of countries near the South Pole, not only use it as their common food, but are fond of it to distraction, and drink the oil as a first-rate delicacy. Jacobson, the naturalist of the Faroe island, after mentioning that his countrymen live a part of the year upon salted gulls, tells us also that they are very fond of salted whale's flesh. The fat of the head they season with bay salt, and then hang it up to dry in the chimney. He thinks it tastes as well as fat bacon; and the lean, which they boil, is in his opinion, not inferior to beef.

THE DOLPHIN, PORPESSE, GRAMPUS, AND THEIR VARIETIES.

THE natural shape of the Dolphin is almost straight, the back being very slightly curved, and the body slender; the nose is long, narrow, and pointed, not much unlike

VOL. IV. D the

the beak of some birds. It is clearly distinguished from the preceding genera by having teeth in both jaws, namely, twenty-one in the upper, and nineteen in the lower jaw; they are above an inch long, conic at their upper end, pointed, and bending a little in. They are placed at a small distance from each other, so that when the mouth is shut, the teeth of both jaws lock into each other: the spout-hole is placed in the middle of the head; the tail is semi-lunar; the skin is smooth, the colour of the back and sides dusky, the belly whitish; it swims with great swiftness, and its prey is fish.

The dolphin has a strong resemblance to the porpesse, except that its snout is longer and more pointed. All these species have fins on the back, and very large heads, like the rest of the whale kind; they resemble each other in their appetites, their manners, and conformation, being equally voracious, active, and roving. No fish could escape them, were it not for the awkward position of their mouth, which is placed in a manner under the head, and their own agility is so great as to prevent them from being often taken. They seldom remain a moment above water, though their too eager pursuit after prey sometimes exposes
them

them to danger; a shoal of herrings often allures them out of their depth, and they continue to flounder in the shallows till knocked on the head, or the returning tide comes to their relief. And when taken they sometimes have a plaintive moan, by which they continue to express their pain till they expire.

Historians and Philosophers seem to have contended who should invent most fables concerning this fish;—it was consecrated to the Gods,—was celebrated in the earliest time for its fondness of the human race,—was honoured by the title of the *sacred* fish, and distinguished by those of *boy-loving*, and *philanthropist*. It gave rise to a long train of inventions, proofs of the credulity and ignorance of the times. Aristotle steers the clearest of all the ancients with respect to these fables, and gives, in general, a faithful history of the animal; but the elder Pliny, and others, set no bounds to their belief of the tales related of this fish's attachment to mankind. Scarcely an accident could happen at sea, but the dolphin offered himself to convey to shore. Arion, the musician, when flung into the ocean by the pirates, who had plundered him, is received and saved by this benevolent fish: and of equal notoriety is the story of the boy, who

D 2

daily

daily took an airing into the midst of the sea upon the dolphin's back, and returned in safety.

In leaping out of the water, this fish assumes a temporary curvature, which is not natural to it; but which the painters and poets, who perhaps on this occasion borrowed from each other, have constantly given them; and which has indeed become too general an error.

By what means this fish became the favorite of antiquity, it is not easy to conceive; its supposed attachment to the human race, in preference to any of the cetaceous tribe, has been detected and justly ridiculed; for had it possessed any such peculiarities, they must long since have been ascertained. Their appearance too, so far from being prepossessing, or received as a favourable omen, is considered by sailors as an unfavourable one, and their gambols as an admonition to prepare for a storm.

The dolphin was formerly reckoned a delicacy: Dr. Caius says, that one which was taken in his time (in the reign of Elizabeth) was thought a present worthy of the Duke of Norfolk, who distributed part of it among his friends. It was roasted and dressed with por-
pesse

pesse sauce, made of crumbs of fine wheat bread, with vinegar and sugar.

It may be necessary to observe, that this species of dolphin must not be confounded with that to which seamen give the same name, but which is quite a different fish, and will afterwards be described among the spinous class, under its proper title.

The *phocaena*, or *porpesse* is found in vast multitudes in all parts of the British seas. Their bodies are thick towards the head, but grow slender towards the tail, forming the figure of a cone. In each jaw are forty-eight teeth, small, sharp-pointed, and moveable; and so placed that the teeth of one jaw lock into those of the other. The eyes are small, as is the spout-hole on the top of the head. In colours the back is black, and the belly whitish—but they sometimes vary. In the river St. Lawrence there is a white kind.—Dr. Borsale in his voyage to the Scilly isles, observed a small species of cetaceous fish, which he calls *thornbacks*, from their broad and sharp fin on the back. Some of these were brown, some quite white, others spotted; but whether they were only a variety of this fish, or whether they were small grampusses, which are also spotted, we cannot determine.

The

The porpesse is remarkable for the vast quantity of fat or lard that surrounds its body, and yields an excellent oil. The nose being furnished with very strong muscles, that enable it to turn up the sand for eels and sea-worms, it is thence in many places called the sea-hog: and the animal sleeps with its snout above the water.

At the season when the fish of passage appear, as mackrel, herring, pilchards, and salmon, the porpesses swarm, and pursue them even up the rivers with great avidity, following their game like a pack of hounds. In Cornwall during the pilchard season, they often do much mischief, by a universal laceration of the nets, and interrupting the fishery. In some places they almost darken the sea, as they rise above water to take breath, which they do very frequently.

The porpesse was a royal dish even so late as the reign of Henry VIII. as appears from the household book of that Prince, quoted in the third volume of the archæologia; and must, from its size, have held a respectable situation at the princely board; it continued in vogue even in the reign of Elizabeth.

There are evidently in men many palates and tastes as well as minds and opinions; and the
tastes

tastes of people of the same country vary much in different ages. Stinking fish is a luxurious food to the negroes of the coast of Guinea; the stranding of a whale on Fox islands is such a happy event, that the inhabitants immediately collect round the oily animal, and with sundry tokens of joy and exultation, devour the best parts of it before they separate; and in England we see that what two hundred and fifty years ago was a feast for a king, is now abhorred by a peasant. But would not our ancestors have had some cause for astonishment, could they have foreseen that there would be annually a large importation of an amphibious creature from the East and West Indies to qualify the taste of the British epicures of the eighteenth century? the porpesse is disgusting to us, and the taste of calipash and calipee is exquisite: yet might not this to our eighth Henry, and to those of his courtiers, who were no less *bon-vivans* than their sovereign, be a fish and a dish equally monstrous?

Such is the violence of the porpesse, as we have already observed, in pursuit of its prey, that it will follow a shoal of small fish up a fresh water river, from whence it finds a difficulty to return. These creatures have been often

often taken in the river Thames, both above and below London-bridge; and it is curious to observe with what dexterity they avoid their pursuers, and how momentarily they recover their breath above the water. It is usual to spread four or five boats over the part of the river where they are seen, and to fire at them the instant they rise.

The porpesse yields no inconsiderable quantity of oil, and its capture is therefore rendered an object of consideration. The lean of the young ones is also said to be well tasted, and not unlike veal. They go with young ten months; they seldom bring forth more than one at a time, and generally in the summer: from the *ova* found in this fish, a kind of caviare is made, which is eaten as a sauce, or with bread. It is conjectured that they live about thirty years.

The *Orca*, or *Grampus*, was very justly called by Pliny "an immense heap of flesh armed with dreadful teeth." It is said to be an enemy to the whale, on which it will fasten like a dog upon a bull, till the animal roars with pain; and it is so voracious as not even to spare the porpesse, though of so kindred a nature. They are found from 15 to 25 feet long; and so thick in proportion to their length, that one of 18 feet long is, in the thickest part, more than

than ten feet diameter. There are 30 teeth in each jaw; those before are blunt, round, and slender; the farthest sharp and thick, and which look into each other like those of the porpesse. The spout-hole is in the top of the neck; the colour of the back is black, but on each shoulder is a large white spot; the sides marbled black and white, the belly of a snowy whiteness. They seldom appear on our coasts, but are found in great quantities off the North Cape in Norway, whence they are termed North Capers.

The *Beluga of the Sea* is from 12 to 18 feet in length, has a short head, blunt nose, very minute eyes, and a small mouth, with 36 short blunt teeth; the pectoral fins nearly of an oval form; and beneath the skin may be felt the bones of five fingers, which terminate at the edge of the fin in five very sensible projections. The tail is divided into two lobes, which lie horizontally; but do not fork, except a little at the base, and it has no dorsal fin. In swimming, this fish bends its tail under it like a lobster, and works it with such force as to dart along with the rapidity of an arrow.

This fish is common in all the arctic seas, and forms an article of commerce, being taken

on account of its blubber. There are fisheries for them and the porpesse in the river St. Lawrence:—a considerable quantity of oil is extracted from them, and of their skin is made a sort of morocco leather, thin, yet strong enough to resist a musket ball. They are usually caught in nets, but are sometimes harpooned. They produce only one young at a time, which is dusky, but grows white in proportion to its age, the change first commencing on the belly. They are apt to follow boats, as if they were tamed, and appear extremely beautiful, on account of their resplendent whiteness.

OF CARTILAGINOUS FISH IN GENERAL.

CARTILAGINOUS is a title given to all those fish, the muscles of which are supported by cartilages or gristles, instead of bones.

A certain ambiguity of character marks this class in every point of view; and which forms one of those singular shades that complete the imperceptible gradations of nature.

Cetaceous

Cetaceous fish approach the nearest to quadrupeds, as well in their conformation as in their manners; their bones are thick, white, and filled with marrow; but fish of the cartilaginous kinds have their bones always soft and yielding; and which, uninfluenced by the common effects of age, while it hardens the bones of the animals, rather contributes to soften theirs. The size of all bony fish is supposed to increase with age, though certainly within a limited degree; but from the pliability of the cartilaginous substitute in this tribe, it must be highly difficult to place bounds to their dimensions, or not to suppose that they may increase in bulk until the termination of their existence.

Cartilaginous fish unite in their formation several leading properties of the other two tribes. Like the cetaceous, they have lungs; and like the spinous, they have gills, and a heart without a partition: thus they possess a twofold manner of breathing, sometimes by their lungs, and sometimes by their gills. And this double capacity of breathing in cartilaginous fish, is one of the most remarkable features in the history of nature; as they are thus enabled to unite all the advantages of

which their situation is capable, and drawing from both elements every aid to their necessities or their enjoyment.

The apertures by which they breathe are variously placed: the shark has them in the sides of his head, the pipe-fish on the top, and the flat-fish generally beneath. The gills are affixed to these apertures, but “without any bone to open and shut them,”—a circumstance that essentially distinguishes the cartilaginous from the spinous class of fish, however great the resemblance in other respects. From the gills are cylindrical ducts, running to the lungs, and which are supposed to convey the air that gives play to the organs; but as the gills want the pulmonary vein and artery, they are supposed to be ineffectual for supplying the same offices as in quadrupeds; the heart, also, having but one valve, must preclude the blood from that double circulation which it obtains in the cetaceous kind.

This tribe is evidently possessed of certain superior advantages to both the cetaceous and spinous; and is enabled to live a much longer time out of the water than those whose gills are more simple; they can venture their heads
above

above the deep, and continue for hours out of their native element, as we experience in the shark and ray, which can live some hours after being taken, though the spinous herring or mackerel expire in a few minutes. They also possess an advantage over the cetaceous fish, in being able to remain continually under water without ever taking breath.

The cartilaginous, like the cetaceous fish, are said to have their amorous intercourses *more humano*, in which situation they are often discovered; they have, however, this distinguishing peculiarity, that the male possesses two instruments of generation. They generally chuse colder seasons and situations for propagating their kind than other fish; and many of them bring forth in the midst of winter.

Though some of these fish bring forth their young alive, and some bring forth eggs, which are afterwards brought to maturity, yet the manner of gestation is nearly the same in all; for, upon dissection, it is uniformly found that the young, while in the body, continues in the egg until a very little time before they are excluded. Quadrupeds, and the cetaceous tribe, are excluded from the ovum in a short period after their first conception, and continue in the womb

womb several months after: but cartilaginous fish may properly be said to hatch within their bodies, where the young remains in the egg state for weeks together; and the eggs are united by a membrane, from which, when the foetus gets free, it continues but a very short time till it delivers itself from its confinement in the womb.

Of those genera which bring forth their young alive, may be ranked the shark, and the ray kinds; while the sturgeon, and many of the slender shaped sorts, exclude their progeny in the state of eggs, before the animal is come to its state of disengaging. The eggs themselves consist of a white and yelk; but the substance that corresponds with the shell in the ærial tribe may aptly enough be compared to horn.

Such are the leading characteristics of cartilaginous fish: and we may observe that there is very little difference between the *viviparous* and the *oviparous* kinds:—that the one hatch their eggs in the womb, and the young are soon excluded after incubation: while the others exclude their eggs before hatching, and leave the future care of their offspring to time and the operations of nature.

Cartilaginous

Cartilaginous fish, of all others, abound with the greatest variety of ill-formed and mishapen individuals; it might be unphilosophical to call them the class of monsters; though in fact they exhibit a variety of shapeless beings, the deviations of which from the usual form of fish, Goldsmith very elegantly observes, “are beyond the power of words to describe, and almost of the pencil to draw.”

Nature seems to have made a four-fold division of this class, whose arrangement we shall endeavour, as nearly as we can, to follow, pointing out the most striking peculiarities of each.

The *first division* is that of the shark kind, with a body growing less towards the tail; a rough skin, with a mouth placed far beneath the end of the nose; five apertures on the sides of the neck for breathing; and the upper part of the tail longer than the lower.

The *second division* comprehends the sturgeon, and its varieties.

The *third division* is that of flat fish, whose broad, flat, thin shape is sufficiently capable of distinguishing them from all others of the kind. The scate, the torpedo, the ray, &c. are placed in this tribe, and all these may be easily distinguished from spinous flat fish,
by

by the holes through which they breathe, which in this kind are five on each side, and are not covered by any bone.

The slender, snake-shaped kind, such as the lamprey, &c. constitute the *fourth division*.

To these may be added an anomalous catalogue, comprising several fish, whose figures and natures are unlike any thing that is regular, yet whose formation and powers have something deserving of notice and record. A description of the lump-fish, the sun-fish, the fishing frog, chimera, &c. must compensate for the want of their particular history.

OF THE SHARK AND ITS AFFINITIES.

THIS tremendous and voracious animal may, with great propriety, rank next to the whale in magnitude, as it is often found nearly thirty feet in length, and of corresponding weight and bulk. Its mouth and throat are enormously wide, and capable of admitting a human carcase; which, we are told, has been repeatedly found in their bellies. His head is large and flattened; his snout is long, and the eyes large and goggling, projecting in such a manner as to enable him to behold his prey on every side. But the teeth are the most formidable part of his composition; they consist of six rows, amounting to one hundred and forty four in number, hard, sharp-pointed, and wedge-like in their form: and the creature is possessed of the singular power of erecting or depressing them at pleasure. They lay flat in his mouth when at rest, but by the

help of a set of muscles he is enabled to erect them when he wishes to seize his prey ; on which he can inflict a hundred wounds at once.

Of all the inhabitants of the deep, the shark is certainly the fiercest ; his aspect is peculiarly expressive of the malignity of his character ; he is dreaded by the lesser tribes, nor is he hardly less obnoxious to those that are apparently more powerful ; for he surpasses the whale in strength and celerity not more than he exceeds all the rest in his insatiable appetites. His fins are larger in proportion than those of most fish ; and his skin is rough, hard, and prickly, and of which shagreen is made for various purposes. His powers of destruction are only counterbalanced by the difficulty he meets with in seizing his prey ; for his upper jaw projects so far over the lower, that he is obliged to turn on one side in order to accomplish his purpose ; and thus afford his affrighted victims the only probability of escape.

It has been observed by Mr. Pennant, that the female in this tribe is larger than the male ; a circumstance strongly characteristic of their nature, and forming a striking agreement between them and birds of prey. But

we cannot so readily believe the assertions which have been made respecting the fecundity of these animals, as it militates against the observed rules of nature: though Belon assures us that he saw a female shark produce *eleven* live young ones at a time.

However formidable this creature may be when living, he is of little use when dead. The negroes are said to be fond of the flesh, which is, however, very tough and undigestible; the liver affords a few quarts of oil; and the skin, as we have noticed, is, though with great labour, polished into shagreen.

Among its singularities may be reckoned its enmity to man, or rather its love of human flesh; which when it has once tasted, it never desists from haunting those places where it expects the return of the prey; along the coasts of Africa, where these animals are found in great abundance, numbers of the negroes, who, for various purposes, are obliged to frequent these waters are seized and devoured by them every year; and it is added, that they manifest a preference to the flesh of black men. But though the shark may be called a common enemy, he has no opposition but from the human race, who have contrived different methods to destroy him. The

instance of the *Remora*, or Sucking fish, might perhaps be opposed to this remark, were we convinced that the *remora* attends this monster for any hostile purpose.

The shark often falls a victim to his own rapacity, by means of the stratagems employed to take him: the method of doing which with our English sailors is to bait a large hook with a piece of beef or pork, and throw it into the sea, tied by a strong cord strengthened near the hook by an iron chain. Without this precaution the shark would quickly bite the cord in two, and set himself at liberty. It is amusing to observe the struggle with temptation, even when this voracious animal is not pressed by hunger. He approaches, examines, and swims round it: seems for a while to neglect it, as apprehensive of the delusion; but his voracity encreasing, he returns as if ready to seize it, but apprehension again drives him back; thus like a youthful sinner, he keeps agitated between desire and fear, while the sailors continue to divert themselves with his contending passions, till they make a pretence of drawing the bait away, when propelled by every appetite at once, he darts rapidly at the bait and makes one ravenous gulp of it, hook and all.

When

When the hook is lodged in his maw, his efforts are most strenuously, though vainly, exerted to get free: he endeavours to cut the chain with his teeth; he labours with all his force to break the line; and his exertions to disgorge the hook, almost turn his stomach inside out; until enfeebled by unsuccessful attempts, and quite exhausted, he permits the sailors to drag him out of his native element, and dispatch him, which is done by repeated and severe blows on the head.

But in dragging him on ship-board, much caution is necessary; for both difficulty and danger are frequently experienced: in the agonies of death he is terrible, and struggles powerfully with his executioners: his head and tail are secured and fastened at the same time; the latter is frequently afterwards cut off with an axe, to prevent his flouncing, the consequence of which might be highly dangerous. And such is the degree of vitality, or strength of the vital principle in the shark, that he is killed with more difficulty than almost any other animal in the world: nay when cut in pieces, the muscles still preserve their motion, and vibrate for minutes after being separated from the body.

The African negroes are said to take a
bolder

bolder and more dangerous method of destroying this terrible enemy. With no other instrument than a long knife, he plunges into the water, when he sees the shark watching for his prey, and boldly swims forward to meet him, who suffers his antagonist to approach; but on turning on his side to meet the aggressor, the negro, attentive to that opportunity, plunges his knife into the fish's belly, and pursues his blows with such success, that he soon destroys the ravenous tyrant, who afterwards becomes a noble feast for the adjacent neighbourhood.

Nothing that has life is ever rejected by this rapacious animal; but, as we have before observed, human flesh seems to be his peculiar gratification, and to afford him the highest relish:—of his depredations of this nature we have many instances related by different writers. The story of Mr. Brooke Watson, an alderman of London, who in his youth had his leg snapped off by one of these watery depredators, is generally known.

Mr. Pennant tells us, that the master of a Guinea ship, finding a rage for suicide prevail among his slaves, from a notion entertained by those unhappy creatures, that after death they should be restored again to their family,

family, friends, and country; to convince, them that, at least, some disgrace should attend them here, he ordered one of their dead bodies to be tied by the heels to a rope, and so let down into the sea; and though it was drawn up again with great swiftness, yet in that short space of time, the sharks had bitten off all but the feet.

Dr. Goldsmith relates a circumstance, in which the catastrophe, though somewhat similar, was yet more terrible. A Guinea Captain was, by stress of weather, driven into the harbour of Belfast, in Ireland, with a lading of very sickly slaves, who, also, took every opportunity to throw themselves overboard, when brought upon deck, as is usual, for the benefit of the fresh air. The Captain perceiving, among others, a female slave attempting to drown herself, pitched upon her as a proper example to the rest. As he supposed that they did not know the terrors attending death, he ordered the woman to be tied with a rope under the arm-pits, and so let her down into the water. When the poor creature was thus plunged in, and about half-way down, she was heard to give a terrible shriek, which was at first ascribed to her fears of drowning; but soon after the water appearing

appearing red all round her, she was drawn up, and it was found that a shark, which had followed the ship, had bitten her off from the middle.

The *blue shark*. One of this species was caught in 1779 on the coast of Devonshire; the skin of which was stuffed, and deposited in the British Museum.

Dr. Watson, F. R. S. gives the following description of it. The body is of a fine blue colour, dark on the back, lighter on the sides; the fins and tail of a dirty blue; the belly, and all the under part of the fish white. No orifices are to be seen behind the eyes, as is usual with fish of this genus. Two white membranes, one to each eye, perform the office of eye-lids. When the head was placed downwards, a pretty large white pouch came out of its mouth. Ælian supposes this to serve as an asylum to the young brood in time of danger. We mention this opinion, as corroborated by the judgment of Mr. Pennant, who gives credit to the story, and thinks that this fish, like the opossum, may have a place fitted by nature for the reception of her young. Much respect is due to Mr. Pennant's opinion: the fact indeed has been denied by some writers; but nothing, surely, is so contemptible

temptible as that affectation of wisdom which some display by universal incredulity.

The fish alluded to measured six feet eight inches, was a female, and weighed fifty-five pounds.

The *balance-fish* is chiefly distinguished by the formation of its head, spreading on each side into the shape of a balance: or as some have not unaptly compared it, to the head of a mallet, or hammer, except that it is depressed, at the ends of which the eyes are situated.

They inhabit the Mediterranean, and are said to grow to a very great size, indeed, little inferior to the whale: when young the colour is uniformly yellow; the adults have the upper part black, the lower white.

The *saw-fish* has its nose lengthened into a long flat gristly body, armed on each side, with from twenty-four to twenty-seven slender teeth; the lips are covered with rough hard tubercles instead of teeth; an aperture behind each eye for the discharge of water; two dorsal fins; a narrow slip cut half way down the inner side of the ventral fins; the end of the tail obliquely truncated; and the fish is about twenty feet in length.

It inhabits all seas from Greenland to those of the Brasils; it is also found in those of Africa, and of the East-Indies. Some writers have misnamed this fish, or confounded it with the sword-fish, (which see properly characterised under the head *xiphias*, among the spinous fish.) Anderson, Crantz, and other writers on the natural history of Greenland and Iceland, make it the enemy of the seals and whales; asserting that it eats only the tongue of the latter, leaving the rest of the huge carcase a prey to the morses and sea birds.



Sea Devil. FIG. 99.



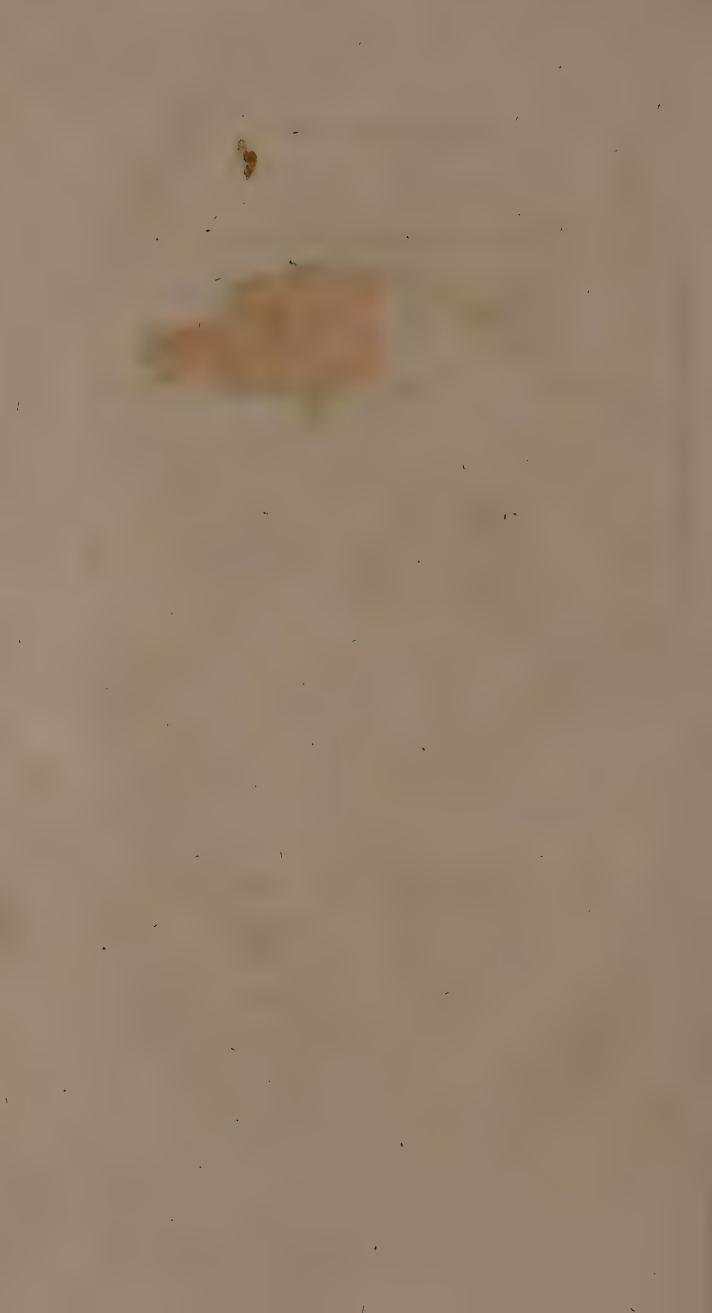
Ray Fish. FIG. 97.



Ray Fish. FIG. 98



Sturgeon. FIG. 100.



THE STURGEON, HUSO, &c.

THE *Sturgeon* is a well-known, large, and fine-tasted fish ; in its general form it resembles a fresh water-pike : the delicacy and firmness of its flesh is much admired, which is as white as veal ; its body is as large, and its form scarcely less terrible than the fish we have just described ; the sturgeon is yet so harmless, so incapable and unwilling to injure others, that it flies from the smallest fish, and generally falls a victim to its own timidity. It is one of those fish which spend part of their time in rivers and part in the sea ; but it never ventures far out, usually frequenting such parts as are not far from the estuaries of great rivers. The most that we receive, and generally pickled, comes either from the Baltic rivers, or North America ; though they have been accidentally caught in the Thames ; the largest perhaps ever caught in Britain was one taken in the river Eske, in Cumberland, which weighed four hundred and

sixty pounds. The body of this fish is formidable to appearance, being furnished with five rows of large bony protuberances, and a number of fins; the nose is long, the mouth is situated beneath, small, and without jaw-bones, or teeth.

As the sturgeon is by no means a voracious animal, it is never caught by a bait, in the ordinary manner of fishing, but always in nets, composed of small cords, and placed across the mouth of the river, but in such a manner, that whether the tide ebb or flow, the pouch of the net goes with the stream. Indeed, from the conformation of its mouth, it is not probable that the sturgeon would swallow any hook capable of holding so large a bulk, and so strong a swimmer.

They usually go up the rivers in the beginning of summer to deposit their spawn, when the fishermen make a regular preparation for their reception; and though in the water they are very strong, and much addicted to flouncing, yet when drawn up they become a lifeless, spiritless mass, and are quietly dragged on shore.

Great numbers are thus taken during the summer months in the lakes, Frischehaff, and Curisch-hall, near Pillau, at the mouth of the Wolga, and other rivers that run into the
Caspian

Caspian Sea. The adjacent shores are formed into districts, and farmed out to companies of fishermen, some of which are rented at near three hundred a year. They are also found in vast abundance in the American rivers, in May, June, and July; at which time they leap some yards out of the water, and falling on their sides make a noise which may be heard, in still water, at some miles distance.

From its quality of floundering at the bottom of rivers, the sturgeon has received its name, among the Germans, as JOHNSON observes, for the word *stoeren* signifies to wallow in the mud. When opened, there is seldom any thing found in its stomach but a slimy substance, whence it is obvious that it does not live upon any large animals. It grows to the length of eighteen feet, and to the weight of 500 pounds.* In the manner of breeding, this fish is an exception among the cartilaginous kind; being, like the bony fish, oviparous, spawning in the water. Isinglass is said to be sometimes made of the intestines of this fish, but in very small quantities.

The

* Sonnini says, that they often attain to five and twenty feet in length.

The flesh of the sturgeon, when pickled, is well known at all the tables in Europe ; and is even more prized in England than in any of the countries where it is usually caught. The fishermen have two different methods of preparing it : the one is by cutting it in long pieces length-wise, and having salted them, hang them up in the sun to dry : thus prepared, the fish is sold in all the countries of the Levant, and supplies the want of better provisions.

The other method, which is generally practised in Holland, and along the shores of the Baltic, is to cut the sturgeon cross-ways, into short pieces, and put it into small barrels, with a pickle made of salt and saumure ; and in this manner it is generally sold in England.

There is a celebrated epicurean food prepared from the hard roe of the sturgeon, under the appellation of *caviare*, formed into small cakes. It is made by taking out of the spawn all the nerves or strings, then washing it in white wine, or vinegar, and spreading it on a table ; it is then salted and pressed in a fine bag, after which it is cased up in a vessel with a hole at the bottom, that all the superfluous moisture may drain off. This kind of food is in great request among the Muscovites, on account of their three Lents ; a pretty large quantity

quantity of it is also consumed in France and Italy, but it seems to be sinking into disuse at the politest English tables, where it was formerly in high esteem. It is still a considerable merchandise among the Turks, Greeks, and Venetians. The best kind is said to be prepared from the *Belluga*, a fish caught in the Caspian Sea: and a kind of caviare, or sausage, is also made from the spawn of some other fish, particularly a sort of mullet caught in the Mediterranean.

There is another sort of *sturgeon*, distinguished, by fifteen scaly protuberances, a native of Russia, and called *Buthenus*, in the technical language of Linnæus, but is probably the caviare sturgeon of other writers.

The *huso* is a fish very much resembling the sturgeon, and classed by Linnæus under the same genus, *accipenser*: it is a native of Russia and the Danube;* the body is naked, that is, it has no protuberances; it grows frequently to twenty-four feet in length, and the skin is so tough and strong, that it is employed for ropes, in carts and other wheel
carriages.

* It is rarely found any where except in the Caspian and Black Seas; and it ascends only as far as the Volga, the Danube, and the other great rivers, which empty their waters into these two seas.

carriages. Its flesh is soft, glutinous, and flabby ; but when salted acquires a better taste, and turns red like salmon ; it is caught from October to January, and weighs from seventy pounds to almost four hundred ; but it is chiefly taken for the purpose of furnishing that useful commodity *isinglass*, so famous as an agglutinating medicine, as well as for the fining of wines, for both which uses, it appears that this fish was known to the ancients.

The art of making isinglass was long a secret in the hands of the Russians ; but it has lately been discovered, and the following account of it published by Humphrey Jackson, Esq. in the 63d vol. of the Philosophical Transactions.

“ All authors, says he, who have hitherto delivered processes for making isinglass, have greatly mistaken both its constituent matter and preparation.

“ In my first attempt to discover the constituent parts and manufacture of isinglass, relying too much upon the authority of some chemical authors, whose veracity I had experienced in many other instances, I found myself constantly disappointed. Glue, not isinglass, was the result of every process, and although in the same view, a journey to Russia proved fruitless, yet
a steady

a steady perseverance in the research proved not only successful as to this object, but, in the pursuit, to discover a resinous matter plentifully procurable in the British fisheries, which has been found by ample experience to answer similar purposes.

“ It is now no longer a secret that the lakes and rivers in North America are stocked with immense quantities of fish, said to be the same species with those in Muscovy, and yielding the finest isinglass; the fisheries whereof, under due encouragement, would doubtless supply all Europe with this valuable article.

“ No artificial heat is necessary to the production of isinglass, neither is the matter dissolved for this purpose; for, as the continuity of its fibres would be destroyed by solution, the mass would become brittle in drying, and snap short asunder, which is always the case with glue, but never with isinglass.

“ The latter, indeed, may be resolved into glue with boiling water; but its fibrous recombination would be found impracticable afterwards, and a fibrous texture is one of the most distinguishing characteristics of genuine isinglass.

“ The sounds, or air bladders, of fresh water fish in general, are preserved for this

purpose, as being the most transparent, flexible, delicate substances. These constitute the finest sorts of isinglass; those called *book* and *ordinary staple*, are made of the intestines, and probably of the peritanæum of the fish. The *belluga* yields the greatest quantity, as being the largest and most plentiful fish in the Muscovy river; but the sounds of all fresh water fish yield more or less fine isinglass, particularly the smaller sorts, found in prodigious quantities in the Caspian Sea, and several hundred miles beyond Astracan, in the Wolga, Yoik, Don, and even as far as Siberia, where it is called, *kle* or *kla*, by the natives, which implies a glutinous matter; it is the basis of the Russian glue, which is preferred to all other kinds for its strength.

“ Isinglass receives its different shapes in the following manner :

“ The part of which it is composed, particularly the sounds, are taken from the fish, while sweet and fresh, slit open, washed from their slimy *sordes*, divested of every thin membrane which envelopes the sound, and then exposed to stiffen a little in the air. In this state they are formed into rolls about the thickness of a finger, and in length according to the intended size of the staple; a thin membrane

brane is generally selected for the centre of the roll, round which the rest are folded alternately, and about half an inch of each extremity of the roll is turned inwards. The two dimensions being thus obtained, the two ends of what is called *short staple*, are pinned together with a small wooden peg: the middle of the roll is then pressed a little downwards, which gives it the resemblance of a heart shape: and thus it is laid on boards, or hung up in the air to dry. The sounds, which compose the long staple, are longer than the former; but the operator lengthens this sort at pleasure, by interfolding the ends of one or more pieces of the sound with each other. The extremities are fastened with a peg like the former, but the middle part of the roll is bent more considerably downwards; and, in order to preserve the shape of the three obtuse angles thus formed, a piece of round stick, about a quarter of an inch diameter, is fastened in each angle with small wooden pegs, in the same manner as at the ends. In this state it is permitted to dry long enough to retain its form, when the pegs and sticks are taken out, and the drying completed: lastly, the pieces of isinglass are colligated in rows,

by running packthread through the peg-holes for convenience of package and exportation.

“ The membranes of the *book* sort being thick and refractory, will not admit a similar formation with the preceding; the pieces, therefore, after their sides are folded inwardly, are bent in the centre, in such a manner that the opposite sides resemble the cover of a book, from whence its name, a peg being run across the middle, fastens the sides together, and thus it is dried like the former. This sort is interleaved, and the pegs run across the ends, the better to prevent its unfolding.

“ That called *cake isinglass*, is formed of the bits and fragments of the staple sorts, put into a flat metalline pan, with a little water, and heated just enough to make the parts cohere like a pancake, when it is dried; but frequently it is overheated, as such pieces, as before observed, become useless in the business of fining. Experience has taught the consumer to reject them.

“ It has long been a prevalent opinion, that sturgeon, on account of its cartilaginous nature, would yield great quantities of isinglass; but, on examination, no part of this fish, except the inner coat of the sound, promised the
the

the least success. This being full of *mucus*, adheres so firmly to the external membrane, which is useless, that the labour of separating them supersedes the advantage. The intestines, however, which in the larger fish extend several yards in length, being cleansed from their mucus, and dried, were found surprisingly strong and elastic, resembling cords made with the intestines of other animals, commonly called *cat-gut*, and, from some trials, promised superior advantages, when applied to mechanic operations."

OF CARTILAGINOUS FISH, VIZ. THE RAY,
SCATE, THORNBACK, &c.

THE fish of this division, or Ray-fish, are characterised by swimming flat in the water; having their eyes and mouth placed quite under the body, with apertures for breathing either about or near them: and by having teeth, or a rough bone answering the same purpose.

purpose. The tail differs materially from other fish, being narrow and ending in a bunch or point, and having thus a great resemblance to that of quadrupeds. Their bowels are wide towards the mouth, and gradually diminish towards the tail.

The essential distinction, however, is the spines or prickles which they have on different parts of their body, or at the tail; and which in some are comparatively soft and feeble, and in others strong and piercing. Some are armed with these spines both above and below; others have them on the upper part only; some have their spines on the tail; some have three rows of them, and others but one. The smallest of these spines are usually those that incline towards the tail; the larger towards the head.

The whole of this tribe resemble each other so much in their external form, that experience only can make any distinction; and that distinction consists especially in the situation of their spines.

The *thornback*, or prickly ray, has its spines disposed in three rows upon the back; a transverse cartilage in the belly; the head and body very flat and depressed; the figure of the body, exclusively of the tail, is nearly square; the

the tail long and slender, but a little depressed or flattened; the belly altogether plain, but rising a little in the middle into a convexity; the eyes, which stand on the uppermost part of the body, at a considerable distance from the beak, are a little protuberant, and covered with a simple naked skin; the mouth is situated on the under side of the body, and lies in a transverse direction; it is very large, and stands at the same distance from the extremity of the beak as the eyes do.

The *rough-ray* has its spines spread indiscriminately over the whole back.

The *sharp-nosed ray* has ten spines that are situated towards the middle of the back.

The *skate* has the middle of the back rough, and a single row of spines on the tail. This is a well-known fish, long and flat, if not caught before his full growth, at which period he is from five to six feet in length. His skin is black, and so very hard and rough, that it is often employed in polishing wood and ivory like the skin of a sea-dog. This fish is extremely voracious, and armed with terrible teeth; yet he has recourse to stratagem in catching his living food, by concealing himself under the sands. The French make of its ashes an excellent soap for a certain cutaneous

neous disease, which is generally cured by sulphur, and which by them is called *Savon d'Ange*.—Pliny attributes to the flesh of this fish a singular virtue, when applied fresh to the necks of women, that of preventing them from growing too large: it is certain it was very much used by the Romans: and Rondelet, one of the first naturalists of the sixteenth century, assures us, that he tried the experiment with success.

The *fire-stare* has but one spine, but it is a terrible one. It is placed on the tail, about four inches from the body, and is not less than five inches long; of a flinty hardness, the sides thin, sharp pointed, and closely and sharply bearded the whole way.

The *torpedo* comes under the same genus as the preceding, with which it certainly corresponds in form, though it possesses some very distinguishing peculiarities: it has no spines with which it can wound: but its benumbing or torporific quality is one of the most potent and extraordinary faculties in nature. Such are the most marked properties of this dangerous class; and without a knowledge of which, the unlucky stranger might imagine he is only handling a skate, when he is instantly palsied by a torpedo; or suppose that he
has

has caught a thornback, until he is stung by the fire-flare. Thus they are as injurious to those who are ignorant of their qualities, as useful to him who can distinguish their characteristics.

In their use indeed they differ much, but their similitude as to appetite and conformation is perfect and entire. Of all the larger fish of the sea, these are the most numerous, and they owe their numbers to their size; for except the shark and cachalot, there is not any fish that has a swallow capacious enough to take them in; and their spines would make them, even to the shark, a dangerous repast: the size also of many is such, that even the shark himself would be unable to devour them. Nor do they perhaps often meet, for the same rapacity that impels the shark along the surface of the water, actuates the flat-fish at the bottom, where they creep in security, and seize every thing that comes in their way; neither the hardest shells, nor the sharpest spines, giving protection to the animals that bear them: such is their insatiable hunger that they devour all: and such the force of their stomach, that it easily digests all.

Their retreat is generally in such parts of the sea as have a black muddy bottom, where

the largest keep at the greatest depth, and consequently are but seldom seen; and as they may have been growing for ages, the extent of their magnitude must be unknown. The Norwegian *kraken*, which we have already alluded to, is said to be of this class; and though we may suspend our assent to the opinion of its being above a mile over, yet as we know these fish to be the largest inhabitants of the deep, the extravagance of the good Bishop's suppositions does not destroy the probability that fish of this tribe arrive at a most enormous size.

It is well known that English fishermen have often caught ray-fish that have weighed above two hundred pounds: and yet that weight is trifling, compared to their enormous bulk in other parts of the world. Among many instances we need only adduce the account given by Labat of a prodigious ray, speared by the Negroes at Guadaloupe.

“ This fish, (says he) was thirteen feet eight inches broad, and above ten feet from the snout to the insertion of the tail, which was itself in proportion, being no less than fifteen feet long, twenty inches broad, at its insertion, and tapering to a point. The body was two feet in depth; the skin as thick as leather,

leather, and marked with spots, which spots in all of this kind, are only glands that supply a mucus to lubricate and soften the skin. This enormous fish was utterly unfit to be eaten by Europeans; but the Negroes selected some of the nicest bits, and carefully salted them up as a most favourite provision."

The ray-fish generate in May and April, and the females are extremely prolific. No less than three hundred eggs having been taken out of the body of a single ray, covered with a tough horny substance, which they acquire in the womb, by the concretion of the fluids of that organ. When come to maturity, they are excluded, only one at a time, at intervals of three or four hours. These eggs, or purses, as the fishermen call them, are usually cast about the beginning of May, and they continue casting most part of the summer.

During the time of their feeling the œstrum, they are often seen swimming near the surface of the water, and several of the males pursuing one female: and so fast do they adhere in coition, that the fishermen frequently draw up both together, though only one has been hooked.

When the breeding time ceases, which is

about October, they become very poor and thin; but they soon begin to recover, and gradually increase in goodness until the following May, when they reach the highest state of perfection.

The Dutch fishermen, who are indefatigable in their pursuits, begin their operations very early in the winter, in which the English follow them, but seldom with equal success. The method is by lines, and is certainly fatiguing and dangerous; but the value of the capture generally repays the pain. The skate and thornback are very marketable articles, good food, and their weight is from ten to two hundred pounds weight.

The fishermen however are often incommoded by very troublesome visitors; namely by the rough ray, the fire-flare, the sea-devil, and the torpedo; to all of which they have, with good reason, the most mortal antipathy; though in spite of every caution, they sometimes feel the dangerous resentments of this vindictive tribe. Of these the rough-ray is certainly the least pernicious; and a stranger would take it in his hand without any apprehension; though he would soon be convinced that there is no way of seizing the animal but by the little fin at the end of the tail: as there
is

is not a single part of its body that is not armed with spines, which inflict numberless wounds.

But the fire-flare is the dread of the most experienced and boldest fishermen. We have described its offensive weapon, which grows from the tail, barbed, and about five inches in length; an instrument not less dreadful to modern than to ancient fishermen, who have delivered many tremendous fables of its extraordinary effect.

The antient naturalists have not been less prolix on this subject: Pliny has supplied it with a venom that affects even the inanimate creation:—"trees that are struck by it instantly lose their verdure; and rocks themselves are incapable of resisting the potent poison. The enchantress Circe armed her son with a spear headed with the spine of the trygon, as the most irresistible weapon she could furnish him with: a weapon that was to be soon after the death of his father."

The wound that is inflicted by an animal's tail has, no doubt, something terrible in the idea, and may from thence alone be supposed to be fatal: terror might add poison to the pain, and call up imaginary danger: hence the Negroes universally believe that the sting
is

is poisonous: yet they never die in consequence of the wound, and the simplicity of the remedy sufficiently argues the innoxiousness of the wound: for by opening the fish, and laying it to the part injured, it effects a speedy cure. Hence there is sufficient cause to reject its venomous qualities, notwithstanding the assertions of most of the fishermen, and the opinion of some men of learning: the spine of the ray seems in fact to be a weapon of offence, capable of inflicting a very terrible wound, and attended with dangerous symptoms; but not possessed of any degree of poison. The spine has no sheath to preserve the supposed venom on its surface; nor has the animal any gland that separates the noxious fluid. It is fixed to the tail as a quill is into the tail of a fowl, and is annually shed in the same manner: it may therefore be necessary for the creature's defence, but cannot be necessary for its existence.

Spears and darts, says Mr. Pennant, might, in very early times, have been headed with the spine of the fire-flare, instead of iron. The Americans even at present head their arrows with the bones of fish, and from their hardness and sharpness they are no inconsiderable weapons.

 THE TORPEDO.*

WE have already mentioned this creature in the division of Cartilaginous flat-fish; but its celebrity among both ancient and modern naturalists, arises from a remarkable numbness with which it strikes the arm of those that touch it. Its external appearance agrees with that of the ray-fish in general, and much resembles the thornback. It is usually found upon the coasts of Provence, Gascony, &c. in France, (as well as by our own fishermen) where the people eat it without any danger.

The body of the torpedo is almost circular, and thicker than others of the ray kind; the skin

* Among the ancients, Hippocrates is the first who mentions the torpedo, but he does not take any notice of the effect produced upon those who touch it. Yet, Plato, who was almost contemporary with Hippocrates, knew this electrical property of the torpedo, for, in a dialogue he makes Socrates say, "you have confounded me with your objections, like the torpedo, a flat sea-fish, does those who touch it." Aristotle, *B. ix. Ch. 57. Hist. An.* says, that when the torpedo wishes to seize any fish, they conceal themselves in the sand or mud, and numb those that pass above them. The Abyssinians make a singular use of the torpedo in curing fevers. They tie the patient tight upon a table, and then apply several of these fish successively to all his members: this operation gives dreadful pain, but it usually cures the fever.

skin is soft, smooth, and of a yellowish colour, marked as are all the kind, with large annular spots: the tail tapering to the point; and the weight of the fish from a quarter to fifteen pounds. Rhedi mentions one, which he found, weighing twenty-four pounds.

Upon touching the torpedo with the finger, it frequently, though not always, happens, that the person feels an unusual pain and numbness, which suddenly seizes the arm up to the elbow, and sometimes to the very shoulder, or head.

The pain is of a very particular nature, and not to be described by words: yet Lorenzini, Berelli, Rhedi, and Rheaurmur, who all felt it severely, say that it bears some resemblance to that painful sensation felt in the arm upon striking the elbow violently against a hard body; the latter however observes that this gives but a very faint idea of it.

Its chief force is at the instant it begins; it lasts but a few moments, and then vanishes entirely. If a man do not actually touch the torpedo, how near soever he holds his hand, he feels nothing:—if he touch it with a stick, he feels a faint effect:—if he touch it through the interposition of any tolerably thin body, the numbness is felt very considerably: if the hand be pressed very strong against it, the numbness is less, but still strong enough to oblige a man speedily to let go.

Rheaurmur

Rheaurmur accounts for the phenomena of the torpedo in this manner: the torpedo, like other flat fish, is not absolutely flat; but its back, or rather all the upper parts of its body, a little convex: when it did not, or would not produce any numbness in such as touched it, its back, he found, always preserved its natural convexity; but whenever it would dispose itself to resent a touch, or thrust, it gradually diminished the convexity of the back parts of the body, sometimes only rendering them flat, and sometimes even concave.

The very next moment the numbness always begins to seize the arm; the fingers that touched were obliged to give back, and all the flat and concave part of the body was seen again convex: and tho' it only became flat insensibly, yet it returned to its convexity so swiftly that one could not perceive any passage from the one to the other state.

The motion of a ball out of a musket is not perhaps much quicker than that of the fish reassuming its situation; at least the one is not more perceivable than the other. It is from this sudden stroke that the numbness of the arm arises, and accordingly the person, when he begins to feel it, imagines that his fingers have been violently struck. "*It is the*

MERE VELOCITY of the stroke that produces the numbness." This assertion we shall however presently shew to be ill founded. Rheumur adds, that the single stroke of a soft body could never effect this ; but in the present case there is an infinity of strokes given in an instant.

To explain this admirable mechanism, we must give a view of the parts whereon it depends, which consist of two very singular muscles, called by Rhedi and Lorenzini, the *musculi salcati* ; their form is that of crescents, and they take up together almost half the back of the fish, the one on the right side, and the other on the left ; their origin is a little above the mouth, and they are separated from each other by the bronchia, into the last of which they have their insertions. What is singular in them is their fibres, if we may give that name to a sort of smaller muscles, as big as goose quills, of which the two great muscles are formed.

These lesser muscles are hollow cylinders, their length nearly equal to the thickness of the fish, and ranged parallel with each other, all perpendicular to the upper and lower surfaces of the fish, accounting these surfaces as nearly parallel planes.

The

The exterior surface of each of these cylinders consists of whitish fibres, whose direction is the same with that of the cylinder, forming a kind of tube, the cavity of which is full of a soft matter of the colour and consistence of pap, divided into twenty-five, or thirty different little masses, by so many partitions parallel to the base of the cylinder; these partitions are formed of transverse fibres; so that the whole cylinder is in some measure composed of twenty-five, or thirty cylinders placed over each other, and each full of a medullary substance.

We need only now remember, continues Rheaurmur, that when the torpedo is ready to strike its numbness, it slowly flattens the outer surface of its upper part, and the whole mechanism, on which its force depends, will be apparent. By that gradual contraction it bends, as it were, all its springs, renders all its cylinders shorter, and at the same augments their bases. But the contraction being made to a certain degree, the springs again unbend; and if a finger then touch the torpedo, it instantly receives a stroke which shakes the nerves, suspends, or changes the course of the animal spirit:—or, if the idea be more distinct, these strokes produce an undulatory motion in the fibres of the nerves, which

clashes, or disagrees, with what they should have in order to move the arm; and hence the inability we are under of using the same, and the painful sensation which accompanies it. Hence also the torpedo does not convey its numbness to any degree except when touched on these great muscles; so that the fish is very safely taken by the tail, which is the part by which the fishermen catch it.

Lorenzini and others have endeavoured to account for the effect of the torpedo from torporific effluvia; this Rheaurmur objects to with a variety of ingenious arguments; and particularly observes, that the torpedo conveys its numbness to the hand through a hard solid body, but does not do it through the air.

Such are the ingenious hypotheses of Rheaurmur, from whose experiments, however, it is pretty evident, that it is *not necessary*, but *by an effort*, that the torpedo numbs the hand of him that touches it; but his inference cannot so well be admitted, that the whole of this animal's exertions arise from the greatness of the blow which the fingers receive at the time they are struck. The stroke is no doubt powerful; but it is well known that a blow though never so violent on the points of the fingers, diffuses no numbness

numbness over the whole body ; nor indeed, however painful, will it reach beyond the fingers themselves. Blows, to cause numbness, must be applied to some great leading nerve, or to a large surface of the body.

The most probable solution that has been attempted of this extraordinary phenomenon, is the supposition that the shock proceeds from an animal electricity with which this fish abounds, or which it has some hidden power of storing up, and producing on its most urgent occasions. From what Kempfer relates, as well as by all other accounts, the shock received most resembles the stroke of an electrical machine ; sudden, tinkling, and painful : the shocks are entirely similar, the duration of the pain is the same : yet still it exceeds all human knowledge how the electric matter is originally procured, how the animal contrives to renew the charge, or how it is prevented from evaporating on contiguous bodies.

“ The instant, says Kempfer, I touched it
“ with my hand, I felt a terrible numbness
“ in my arm, and as far up as my shoulder.
“ Even if one treads upon it with the shoe on,
“ it affects not only the leg, but the whole
“ thigh upwards. Those who touch it with
“ their

“ their foot are seised with a stronger palpitation than even those who touch it with the hand. This numbness bears no resemblance to that which we feel when a nerve is a long time pressed, and the foot is said to be asleep; it rather appears like a sudden vapour, which passing through the pores in an instant, penetrates to the very springs of life, from whence it diffuses itself over the whole body, and gives real pain. The nerves are so affected, that the person struck imagines all the bones of his body, and particularly those of the limb that received the blow, are driven out of joint. All this is accompanied with an universal tremor, a sickness of the stomach, a general convulsion, and a total suspension of the faculties of the mind.

“ In short, continues Kempfer, such is the pain, that all the force of our promises and authority could not prevail upon a seaman to undergo the force of a shock a second time. A negro, indeed, that was standing by, readily undertook to touch the torpedo, and was seen to handle it without feeling any of its effects. He informed us, that his whole secret consisted in keeping in his breath : and we found, upon trial, that this method

“ answered

“answered with ourselves.”—In this matter, however, Kempfer was mistaken; succeeding experience has abundantly proved, that holding in the breath no way guards against the violence of the shock: and those who depend on such an antidote may be very painfully undeceived.

The baneful powers of this fish are known to decline with its vigour; as its strength ceases, the force of the shock seems to diminish, till at last, when the fish is dead, the whole power is destroyed, and it may be handled or eaten with perfect security. When first taken out of the sea, its force is very great, and not only affects the hand, but even if touched with a stick, the person sometimes feels himself affected. This latent power is said to be more extensive in the female than the male.

But as every phenomenon, not readily accounted for, is generally swelled into the *marvellous*, so we must not believe the torporific influence to be extended to the degree that some would have us believe; as reaching the fishermen at the end of the line, or numbing the fish in the same pond.—Gedignus, in his history of Abyssinia, carries this quality to a most ridiculous excess; for he tells us of one of these that was put into a basket with
some

some *dead* fish, and that the next morning the people to their utter astonishment perceived, that the torpedo had actually *numbed* the *dead fish into life again*.

Were the only use that the torpedo makes of its faculty the saving itself from the fishermen, as some have supposed, it would signify but little, for it very rarely escapes their hands. Most naturalists, therefore, agree, that it likewise serves it for the purpose of catching other fish; and that it is generally found on banks of sand, &c. probably to serve it as a foundation or support for the exerting its faculty.

M. Rheaurmur had no fish alive to see what the torpedo would do to them; but he tried it on an animal approximating to a fish, viz. a drake; which being shut up awhile in water with the fish, was taken out dead; doubtless from its too frequent contacts with the torpedo.

Time and observation have discovered that more fish than this of the ray kind possess this numbing or torporific quality. They are said to be shaped like a mackerel, except that the head is much larger; and, according to Atkins and Moore, are found in great abundance along the coast of Africa: but their powers seem to differ

differ in some respects. Moore observes, "that there was no man in the company that could bear to keep his hand upon this animal the twentieth part of a minute, it gave him so great pain; but upon taking the hand away, the numbness went off, and all was well again. This numbing quality continued in the torpedo even after it was dead; and its very skin was possessed of this extraordinary power till it became dry." This circumstance sufficiently proves that the fish he speaks of, must be some other, as it could not possibly take place with the ray torpedo.

Condamine (says Dr. Goldsmith) informs us of a fish possessed of the powers of the torpedo, and of a shape resembling the lamprey in every respect. This animal, if touched by the hand, or even with a stick, instantly benumbs the hand and arm to the very shoulder, and sometimes the man falls down under the blow. These animals therefore must affect the nervous system in a different manner from the others, both in regard to manner and intention; but how this effect is wrought, is an operation that at present remains in obscurity.

M. du Hamel, in his History of the Academy of Sciences, mentions a kind of torpedo, or torporific animal, which he compares to congor eels. M. Richer, who furnished Du Hamel with the account, affirms, on his own VOL. IV. L knowledge,

knowledge, that they numb the arm strongly, when touched with a staff, and that their effects even produce vertigos.

This torporific eel has been recently mentioned by Dr. Bancroft, in his Natural History of Guiana, in South America, who states the following circumstances respecting it.

“ If the torporific eel is caught with a hook
“ and line, the person that holds the line feels
“ a shock like that of electricity.

“ If a person who touches it with a rod holds
“ the hand of another person—that person of
“ a third—and so on to a dozen, a violent
“ shock will be felt by all at the same instant.

“ If a person holds his finger in the water at
“ the distance of ten feet from the fish, he will
“ receive a violent shock at the moment when
“ the fish is touched by another person.

“ If the fish is enraged, and puts his head
“ above water, and the hand of a person comes
“ within five or six inches of it, he will feel a
“ shock, nearly the same as if he had touched it.”*

* The torpedo is white underneath; but the colour of the upper part varies according to age, sex, and climate. Sometimes this colour is of a light brown, and sometimes reddish; sometimes it has only one shade, and at others a great number of spots. More generally there are five of these spots on the back, very large and round, and disposed like the five angles of a pentagon, generally of a deep blue colour, surrounded sometimes with a black circle, sometimes with a white one, and sometimes with both these circles placed one within the other, and sometimes without any circle at all.

THE LAMPREY.

THIS fish is of a lighter colour and of a more clumsy make than the eel, which however, it much resembles in its general appearance: but its mouth has a greater likeness to that of a leech than an eel, being round, and placed rather obliquely below the end of the nose. The animal has also a hole on the top of the head, through which it spouts water like the cetaceous tribe. On each side are seven holes for respiration; and the fins are formed rather by an elongation of the skin, than any set of bones or spines for that purpose.

Naturalists distinguish between the *lampein* and the *lamprey*; the former is said to have a single row of little teeth in the verge of its mouth, besides the lower large ones. It grows to about a foot and a half, though most of those usually caught are under that standard.—The latter has about twenty rows of teeth, and grows to two feet and a half, or more in length.

Muralto, in his very minute description of this animal, makes no mention of lungs:—yet from some peculiarity in its formation, the lamprey generally swims as near as possible to the surface; and it might easily be drowned by being forcibly kept under water for a considerable time. The absolute necessity it is under of breathing in the air, must convince the attentive observer that it really has lungs; and it is very probable that two red glands tissue with nerves, (described by Muralto as lying towards the back of the head) are no other than the lungs of the animal.

The lamprey usually leaves the sea the beginning of spring, in order to spawn, and after a stay of a few months, returns to it again. The species known among us is differently estimated according to the season in which it is caught, or the place where it has been fed. The best season for them is the months of March, April, and May; and they are usually taken in nets with salmon, and sometimes in baskets at the bottom of the river.

Those that leave the sea to deposit their spawn in fresh waters, are the best; those that are entirely bred in our rivers, and that have never been to sea, are considered as much inferior to the former. Such as are caught after they

they have cast their spawn, are found to be flabby, and of little value, and particularly so at the approach of hot weather. In many parts of Ireland the people will not venture to touch them. Those caught in the Severn are considered as the most delicate of all other fish whatever: and it has been an old custom for the city of Gloucester to present the King annually with a lamprey-pie; and as the gift is made at Christmas, the difficulty of procuring a sufficient quantity is so very great, that the corporation have sometimes been obliged to purchase them at a guinea a piece.

The Lamprey was in high demand among our forefathers: So late as the reign of Henry V. we find that a specific power was granted to two persons to buy, take, and provide all the live lampreys they could, in or out of the Seine, between Rouen and Harfleur; and to two others the like power between Lislebon and Harfleur, so that it should seem Henry V. was not afraid of the ill effects of eating this fish which cost Henry I. his life.

One quality with which this fish is endued deserves notice, namely, its peculiar adhesiveness; for as its mouth is formed very much like that of the leech, so the lamprey, like that creature,

creature, has the property of sticking close, and sucking any body it is applied to. Such is their extraordinary power of adhesion to stones, that we are told of one which weighed but three pounds, and yet it stuck so firmly to a stone of twelve pounds, that it remained suspended at its mouth, from which it was separated with difficulty.

Naturalists ascribe this wonderful power of suction in the animal, to its exhausting the air within its body by the hole over the nose, while the mouth is closely fixed to the object, permitting no air to enter. If this be really the cause, the weight which the fish will be able to sustain may pretty accurately be determined; for it will be equal to the weight of a column of air of the same diameter as the mouth of the fish.

The power of adhesion in the lamprey may also perhaps be somewhat increased by that slimy substance with which its body is all over smeared; a substance that serves equally to preserve its skin soft and pliant, and to keep it in a proper degree of warmth in the watery element. Two lymphatic glands, extending on each side from the head to the tail, serve to separate this mucus, and furnish it in great abundance.

The

The lamprey has no other intestines than one great bowel, running from the mouth to the vent, wide in the middle, but narrow at both ends.

The simplicity of the lamprey's appetite perfectly corresponds with that of its conformation; for its food seems to be either slime and water, or such small water insects as are scarcely perceivable. When it comes into our rivers, it is hardly perceived to eat any thing; though in its native element, the sea, perhaps its appetite may be more active.

The preparation made by the lampreys for spawning is a remarkable circumstance in their natural history. Previously to their depositing their spawn, they make holes in the gravelly bottom of rivers; and if they meet with a stone of considerable magnitude, their power of suction is highly serviceable, and successfully exerted in removing and throwing it out. Like other flat fish, the lampreys are produced from eggs, but are not, like most others, left to chance for their maturation; for the female remains near the place where they are excluded, and continues with them until they come forth. One single brood is the extent of the female's fertility; and according to Rondoletius, she may be frequently
seen

seen playing about them; and after some time she conducts them in triumph back to the ocean, at least such as have sufficient strength for that purpose; the remainder continue in the fresh water until they die, or are caught; but their flavour never equals that of such of them as have undergone a sea-voyage.

The existence of the lamprey is of very short duration:—after casting her eggs, she becomes flabby and exhausted, appears prematurely old, and two years generally put a termination to her natural life.

That the lamprey was the name* of a fish in high esteem among the ancients, is a circumstance pretty generally known; as well as that there is a species of the lamprey served up as one of the greatest dainties among the modern Romans: whether *theirs* be the murena of the ancients, is not easily to be ascertained; but that *our* lamprey is not, needs no argument to prove. The lamprey of the Italians agrees with the ancient fish, in being kept in ponds,
and

* Gesner and Aldrovandus think that the Latin word *lampetra* comes from *alabis*, which, in Greek, signifies a smooth, slippery body, that escapes from the hand, whence proceeds the word *alabastrum*, signifying the most polished marble. There are nine different species of this fish.

and considered by the luxurious as a very great delicacy.

An anecdote recorded by the Roman writers, as it relates to the fish whose history we have just given, may be not improperly repeated here. A senator of rank had attained to very great celebrity for his taste in good eating, and the luxury of his table: his fish in particular were distinguished for flavour and feeding: Augustus became his guest, and found that fame had done justice to his merits—his lampreys were indeed of excellent taste. The Emperor was desirous to know by what means he gave them so fine a relish: the epicure was happy to instruct the Emperor, and told him, “that it was his custom to throw into his pond such of his slaves as had at any time displeased him.” Augustus did not admire the recipe—for he instantly ordered all the man’s ponds to be filled up; and perhaps many of our readers would not be sorry could we have informed them that the owner had been thrown in with the rest of the rubbish.

ANOMALOUS CARTILAGINOUS FISH.**THE SEA ORB.**

OF this unshapely and extraordinary creature, there are several varieties: some threaten only with their spine; others are defended with a bony helmet that covers the head; some with a coat of mail from the head to the other extremity; and others again armed offensively and defensively with bones and spines. Their armour is in all cases formidable, and the greater number of them are venomous in their nature, as fatal experience has proved. In general we know so little of them besides their figure, that naturalists are not agreed what station they ought to hold in the scale of fish:—their deformity, however, is obvious; and the distance at which they are placed from us, being chiefly found in the Oriental or American seas, has, possibly, been the reason why a more critical examination of them has not taken place.

The

The general characteristics of this creature are, its figure almost round; its mouth like a frog, and being from seven inches to two feet long. It is covered with long thorns, which point on every side; and when the animal is enraged, it can blow up its body as round as a bladder.

The *Centriscus* includes two species; one having its back covered with a smooth bony shell, which ends in a sharp spine, under which is the tail. It is a native of the East-Indies. The other, which is found in the Mediterranean, has a rough scabrous body, and a straight extended tail. In both, the head gradually ends in a narrow snout; the aperture is broad and flat; the belly keel-formed, and the belly-fins united. It wounds with its fins.

The *Ostracion Cornutus* is found in the Indian Ocean; it has a long spine in front of each eye, and one on each side the vent, pointing to the tail; the body quadrangular, reticulated with a raised line; the tail very long.

The *Five-spined Coney Fish* is also supposed to be an inhabitant of the Indian Ocean. The body is triangular, and reticulated by sunk lines into hexangular and heptangular meshes, each bound a little within the line by

a black stripe; before each eye a short strong spine; a third on the middle of the back, and one on each side the belly near the vent; the body from the vent to the tail covered with a soft smooth skin; the tail round at the end.

It is probable that this genus has the power of drawing the defenceless parts under the bony coat of the body at the approach of danger. It seems necessary that the parts of the body to which the fins are attached, should be covered with a pliable skin, especially that part of the body near the tail; as fish move forward less with the assistance of their fins, than by the motion of their body sideways; which is exemplified in the common method of impelling a cock-boat, by moving sideways an oar at the helm.

The *Old Wife*, *Ostracion bicaudalis*, a native of the above sea, is of a triangular body, the back sharp; the bony coat on the head and body divided by striæ into many hexangular meshes: the areas rough with numerous granules, ranged in concentric lines; the skinny cover of the body near the tail, and tail fin, marked with largish spots; a strong spine on each side the belly, pointing towards the tail.

A fish, apparently the same as above, except that it has an oval crust upon its tail, is mentioned

tioned among the rarities preserved in Gresham College.

Variety prevails equally in the size as in the figure of these animals; some are not bigger than a foot-ball, and others as large as a bushel; and when enraged can inflate to a considerable degree, and become as round as a globe. They can flatten and erect their spines at pleasure, and increase the terrors of their appearance in proportion to the approach of danger:—for on being provoked, or alarmed, the body that before seemed small, swells to the view, the animal visibly increases in size, its prickles stand erect, and threaten the invader on every side.

These animals are often caught by the Americans, merely for the barren pleasure of destroying them. They bait a line and hook with a piece of sea crab, which the ostracion approaches with flattened spines; but on feeling its mistake, rage takes possession of the creature, the spines become erect, and it is effectually armed at all points; that no one dare venture to lay hold of it, but they drag it to some distance from the water, where it soon expires.

There is a kind of bag or bladder filled with air, found in the belly of most of these animals,
by

by the inflation of which the animal swells itself in the manner above-mentioned.

The figure of the Sea Orb, and all its species is so very abhorrent, that scarce any one would wish to experience them as food, in which case, however, they are absolutely poisonous. The natives of those countries, where they are found, humanely and carefully inform strangers of their danger:—yet the admonition was lost upon a certain sailor at the Cape of Good Hope, who not relying on what the Dutch had told him, concerning the venomous quality of the fish, was resolved to make the experiment, and break through a prejudice which he supposed was founded on the animal's deformity. He tried and eat one, but his rashness cost him his life; he instantly fell sick, and died a few days after.

THE BALISTES.*

THIS name is given as a general one to several fish that differ much in their characteristics; and the most remarkable of which we shall enumerate. The general characters are, that the head is flat, there are eight teeth on each side, and the two anterior ones are longest: in place of gills, the balistes has an aperture immediately above the pectoral fins; the body is flat, the scales are joined together by the skin, and the belly is keeled.

The *Unicorn Fish* (*Monoceros*) whose head consists but of one ray; Catesby informs us that the guts of this fish are full of small shells, and coralline substances, which, by the strength and hardness of its jaws, it is enabled to grind very small. They mostly frequent those seas among the Bahama Islands, where the corals are

* Of this fish there are twenty-eight species enumerated by Lacépède.

are in greatest plenty. These fish are not eaten being accounted poisonous.

The *Long File Fish*, described by Walcot. The body not very deep; the skin divided by smooth furrows with small rough scale-like spaces:—each of these on the sides have a small spine pointing towards the tail; the first dorsal fin has three spines, the first of which is very large and rough in front, like a file, and hence the English name; the third very short, and situated at a considerable distance from the other two; the skin of the back and belly at the base of the dorsal and anal fins drawn out and compressed; pectoral fins small; dorsal and anal fins triangular, and situate nearly opposite each other; the tail even at the end.

The first dorsal fin of this fish is possessed of a singular property;—namely, that no force can depress the first spine, but if the last be depressed in ever so gentle a manner, the other two immediately fall down with it; and as instantaneously as when a cross-bow is let off by pulling the trigger. One sort, found in the Mediterranean, near Rome, is on that account called *Pesce Balestra*, i. e. the Cross Bow Fish.

Walcot

Walcot also mentions another species, the body of which is much compressed and deep; the rays of the first dorsal fin spiny; the first ray very long and rough; first dorsal fin and the back from its base black; rest of the body and the head a golden yellow; skin rough; tail rough; and in the place of each ventral fin a long rough spine.

A species, named *Hispidus* by naturalists, is found in Carolina; the head fin is not radiated, and there is a round black spot in the tail fin. The body is rough, and bristly towards the tail. The spine or horn is situated between the eyes; and instead of a belly fin it has a jagged sharp spine.

Several more species or varieties, are found in the Indian Ocean, and at Ascension Island.

SEA-HORSE :—HIPPOCAMPUS.

This creature resembles more a great caterpillar than a fish: the head bends down towards the belly, and from its form gives

name to the animal, which never exceeds nine inches in length, and is about as thick as a man's thumb.

The whole body seems to be composed of cartilaginous rings, on the intermediate membranes of which several prickles are placed.—The snout is a kind of tube, with a hole at the bottom, to which there is a cover that the animal can open and shut at pleasure. Behind the eyes are two fins that look like ears; and above them are two holes that serve for respiration. The tail generally curls downward; along the ridges are a row of tubercles; the whole animal is speckled; and while alive it is said to have hair on the fore part of its body, which falls off when it is dead.

One species of this fish is common in the Mediterranean and Western Ocean; but in place of tubercles has short spines.

Another species, smooth, and without spots, is found in the streights of Sunda, in the East Indies.

The ancients considered this creature as extremely venomous:—an opinion arising probably from the singularity of its figure.—
 “On the sea coast, near Pozzuoli, in Italy,
 “says a modern traveller, are found certain
 “little dried animals, called *Cavalli Marini*,
 “about

“about the length of one’s thumb; its head
“resembles a horse’s, and its body termi-
“nates in a tail like that of a shrimp. The
“the ladies make use of them to encrease
“their milk.”

THE PIPE FISH.

THE thickest part of this animal’s body does not exceed that of a swan-quill, while its length is above sixteen inches. The body is angular, but the angles not being very sharp, are not discernible until the fish is dried.

It is viviparous; for on crushing one that was just taken, hundreds of very minute young ones were observed to crawl about. The general colour of the creature is an olive brown, marked with numbers of bluish lines, pointing from the back to the belly.

THE SUCKER.

THIS genus, according to Linnæus, includes three species :—The head is obtuse, and furnished with saw teeth ; there are four rays in the gills : and the belly fins are connected together in an orbicular lump.

The *Lumpus*, or *lump fish*, grows to the length of nineteen inches, and weighs seven pounds. The shape of the body is like that of the bream, deep and very thick, and it swims edgeways. The back is sharp and elevated ; the belly flat, and of a bright crimson colour. Along the body there runs several rows of sharp bony tubercles, and the whole skin is covered with small ones. The pectoral fins are large and broad, almost uniting at their base.

Beneath these is the part by which it adheres to rocks, &c. It consists of an oval aperture

aperture surrounded with a fleshy, muscular, and obtuse soft substance, edged with many small threaded apendages, which are like so many claspers. The tail and vent-fins are purple. By means of this part it adheres with vast force to any thing it pleases.

As a proof of its tenacity, it has been known, that in flinging it, when just caught, into a pail of water, it fixed itself so firmly to the bottom, that on taking it by the tail, the whole pail by that means was lifted, though it held some gallons, without once making the fish quit its hold.

These fish resort in multitudes during spring to the coast of Sutherland, near the Ord of Caithness, in Scotland. The seals which swarm beneath, prey greatly upon them, leaving the skins, numbers of which thus emptied, float ashore at that season.

It is easy to distinguish the place where the seals are devouring this or any other unctuous fish, by a smoothness of the water immediately above the spot. This fact is now established; it being an ascertained property of oil to still the agitation of the waves, and render them smooth.

Great numbers of lump fish are found in the Greenland seas, during the months of April

April and May, when they resort to spawn. Their roe is remarkably large, which the Greenlanders boil to a pulp and eat. They are extremely fat, an additional recommendation to the natives, who admire all oily food. They call them *nipisets*, or *cat-fish*, and take quantities of them during the season.

The lump-fish is sometimes eaten in England, being stewed like the carp.

The *lesser Sucking-fish* is found in different parts of the British Seas. It is about four inches in length; the skin without scales, slippery, and of a dusky colour. It has also an apparatus for adhering to stones and rocks like the former,

The *Liparis* takes the name of sea-snail from the soft and unctuous texture of its body, resembling that of the land-snail. It is almost transparent, and soon dissolves and melts away. It is found in the sea near the mouths of great rivers, and has been seen full of spawn in January. The length is five inches; the colour a pale brown, sometimes finely streaked with a darker.

Beneath the throat is a round depression of a whitish colour, like the impression of a seal, surrounded by twelve small pale yellow tubera, by which probably it adheres to the stones like the foregoing species.

THE SUN FISH.

RESEMBLES the bream kind, or some deep fish cut off in the middle. The mouth is very small, and contains in each jaw two broad teeth with sharp edges. The colour of the back is dusky and dappled, and the belly is of a silvery white. It grows to a very large size ; and has been taken of the weight of four hundred pounds.

When this fish is boiled, it has been observed to turn to a glutinous jelly ; and would probably serve for all the purposes of isinglass, were it found in sufficient plenty.

THE FISHING FROG.

NOTHING, perhaps, can exceed the deformity of this animal, the head of which is bigger than the whole body. It very much
resembles

resembles a tadpole, or young frog, but of an enormous size, for it grows above five feet long, and its mouth is sometimes a yard wide. The under jaw projects beyond the upper, and both are armed with rows of slender, sharp teeth; the palate and the tongue are furnished with teeth in a similar manner; the eyes are placed on the top of the head, and are encompassed with prickles. Two long beards or filaments are placed immediately above the nose; small in the beginning, but thicker at the end, and they are said to answer the very singular purpose of a fishing line, to which use the animal converts them.

Pliny, as well as many of our best modern naturalists, agree in the above use of those filaments;—"With these extended," say they, "the fishing frog hides in muddy waters, and leaves nothing but the beards to be seen;—the curiosity of the smaller fish brings them to view these filaments, and their hunger induces them to seize the bait; upon which the animal in ambush instantly draws in its filaments with the little fish that had taken the bait, and devours them without mercy." The truth of this has however been doubted because other species of the fishing frog have been found without beards, which
would

would not be wanting, were they necessary to the existence of the genus.

Rondoletius tells us, "that if we take out the bowels of the fishing frog, the body will appear transparent; and if a lighted candle be placed within the body, as in a lanthorn, the whole has a very formidable appearance."

But as the fishing-frog is an enemy to the dog-fish, (a species of the shark) the bodies of these fierce and voracious animals being often found in its stomach, the fishermen generally, therefore, have a regard for it, and whenever they take it, set it at liberty.

THE ARMOUR FISH.

THE Armour Fish (*Catafractus Americanus*) is about one foot in length, and four inches broad; a small part of the belly is cartilaginous, except which, the fish is covered with hard thick bone, but in a different manner, viz. the head and forepart are covered with plates of bone, extending from the back to

the belly, and lapping over one another. It is armed with three strong pointed bones, thick set, or rather separated with teeth, one placed near the back, and one near each gill. These bones are three inches long, and so fixed in sockets, that the fish can point them in any direction in defence of itself. The creature has no teeth as a means of protection. Nature seems to have compensated that deficiency, by bestowing on him weapons and armour in an extraordinary manner.

THE VIPER-MOUTH.

THE Viper-mouth (or *Vipera Marina* of Catesby) is about eighteen inches long ; but as fish are not, like quadrupeds, of a determinate size, so this species is said to grow to a vast bigness. The mouth is excessively wide ; both jaws are armed with sharp destructive teeth, particularly two in each jaw, much longer than the rest, so as not to be admitted within the mouth : most of these long teeth have an angular bending towards their ends, in a very singular manner ; it is without scales, marked all over with hexagonal divisions. Catesby says, that this fish is of the oddest structure, and most formidable appearance of any he ever saw. One of them was taken in the harbour of Gibraltar, and we believe is preserved in the British Museum.

The *Ribband Fish* is found in the Caribbee Islands, and is about six inches in length. It

is brown on the back, whitish on the belly; the fins and tail are of a dusky colour; it has a circle round the eye, and a black spot between the nostrils; it has also a broad black list running round the head, and passing through the eyes; it has two other black or dusky lists bordered with white: the first passing a little obliquely below the head, the other from the long fin on the back quite through the tail, which makes the fish appear as if it were bound with ribbands. The belly is the broadest part, and the back grows gradually thinner towards the neck, which terminates in a ridge.

THE GALLEY FISH.

UPON the authority of Labat, this animal is classed among the cartilaginous fish, to which its habits indeed are somewhat similar. It is supposed by Linnæus to be in part the food of the whale.

Labat, and after him Goldsmith, describes it as having eight broad feet, with which it swims, or which it expands to catch the air as with a sail. It is very common in America, and grows to the size of a goose egg, or somewhat more. It is perpetually seen floating, and no efforts that have been tried can sink it to the bottom. All that appears above water is a bladder, clear and transparent as glass, and shining with the most beautiful colours of the rainbow. Persons who happen to be walking along the sea-shore frequently tread upon these animals, and the bursting of their bodies yields a report like that when one treads upon the swim of a fish.

Indeed

Indeed to the eye of an unmindful spectator, this animal seems most to resemble a transparent bubble swimming on the surface of the sea, or like a bladder variously and beautifully painted with vivid colours, where red and violet predominate, accordingly as they are opposed to the beams of the sun. It is, however, an actual fish, the body of which is composed of cartilages, and a very thin skin, filled with air, which thus keeps the animal floating on the surface, as the waves and the winds happen to drive. Sometimes it is seen thrown on the shore by one wave, and again washed back into the sea by another.

Four of its feet keep in the water, and serve as oars; while the other four are expanded above to sail with: the legs are besmeared with a slimy substance, by means of which it fastens itself to whatever comes within its reach. Whether they move when on shore, Labat could never perceive, though he did every thing to make them stir: he only noticed that they strongly adhered to whatever substances were applied to them.

The most extraordinary quality in this remarkable creature, is the violent pungency of the slimy substance with which its legs are smeared. If the smallest quantity do but touch
the

the skin, so caustic is its quality that it burns it like hot oil dropt on the part affected. The pain is worst in the heat of the day, but ceases in the cool of the evening.

It is from feeding on the galley fish, which is itself most potently poisonous, that such deleterious effects are the consequence of eating many species of fish found about the West-Indian islands. The galley fish is certainly extremely numerous all along the coasts in the gulph of Mexico; and whenever the shore is covered with them in an unusual manner, it is considered as a certain prognostic of a *storm*.

The *Sepiologi*, or Ink Fish, has been placed by Linnæus among worms; others have elevated it among fish; but Dr. Monro is of opinion that it may more justly be considered as a link between those two classes of beings.

The ink-bag is situated on the fore side of the liver, of a conical shape, and considerable size; and from its situation and connection, the anatomist was inclined to think that the ink was the gall of the animal. Yet, as in this case, the bile does not serve any of the purposes assigned to it, but is thrown out merely to assist the animal in its escape, there is some reason to suspect, that one principal use of the liver in the human fabric, may be to drain off from the constitution

constitution some matter that is hurtful to it, or that the bile is an excrementitious liquor.

BONY, OR SPINOUS FISH.

THE tails of all the fish that form this division are placed perpendicularly to the body : they have a complete bony covering to their gills, through which they breathe air and water; and their muscles are supported by bones, or spines, that are sharp and thorny. The haddock is one of this division that best corresponds with the definition we have made. The great resemblance among all the genera of this division, renders their natural history very similar: they all live by rapine, each devouring such of the inferior tribes as fall in their way by accident, or are overtaken by pursuit; they neither bring forth their young alive, like the cetaceous kind, nor produce them from distinct eggs, like the cartilaginous, but deposit a spawn, that is prolific

lific to an astonishing degree. An ingenious French writer, who undertook to estimate the number of eggs, or peas as they are more generally called, in the roe of a moderate sized cod, and which he accomplished by accurately weighing and counting a small portion, found the aggregate to be no less than nine millions three hundred and forty thousand.

The most obvious circumstance in which these fish differ from the preceding classes, is their bony construction, which when slightly examined, appears to be entirely solid ; but when viewed more closely will be found hollow and filled with a substance less rancid and oily than marrow : they are very numerous, and pointed ; and are the props or stays to which the muscles are attached for giving motion to the various parts of the body.

The skeleton of a fish has its members regularly disposed, and every bone is placed with as much precision as in the orders of a regular fabric. The number, indeed, depends on the number of fins by which they move in the water ; consequently those fish, in which the latter are most numerous must be most bony. In the larger kinds, the quantity of flesh abounds, and the bones themselves are

so large, that they are easily seen and separated; but in the smaller kinds with many fins, the bones are as numerous as in the great; yet being so very minute, they lurk almost in every part of the flesh, and are dangerous as well as troublesome to be eaten.

In other words, fish that are large, fat, and have few fins, are constantly the least bony; those on the contrary, that are small, lean, and have many fins, are the most so. The roach, for instance, appears more bony than the carp, merely because it is leaner and smaller; though it is more bony than an eel, having a greater number of fins.

Some modern naturalists, who are, perhaps, too much attached to system, admit only the *spinous* class of the aquatic tribe to the name of fish:—but to this distinction the generality of mankind will not so readily subscribe. The spinous class certainly partake less of the quadruped in their formation than the others; and therefore they can support existence for a shorter time out of their own element. Their sense of a change of element is evidently and speedily testified by a palpitation more violent, and at quicker and closer intervals: our thin air will not allow proper play, or rather exercise, for their lungs, and in general they live but for a few minutes.

Some,

Some, however, are able to retain their vitality for a greater length of time :—the vital principle of the eel, we experimentally know, will remain many hours after it has been taken out of the water ; and carp has been known to be fattened in a damp cellar, and continue in good health for a fortnight together. It has from hence been inferred, that the want of moisture in the gills is the chief cause of the death of these animals ; and could that be supplied, it is probable, that life might be prolonged in the air almost as long as in their native element.

It was a philosophical question proposed to the Royal Society, in a merry mood, by its facetious founder, Charles II.—“ How comes it that fish, which are bred in a salt element, have yet no taste thereof, or that any is capable of being extracted from them ? ” The problem is yet unsolved : and it appears indeed impossible to account for the different operations of the same element upon animals that to appearance have the same conformation : fish that live in our lakes and ponds cannot bear the salt water ; and to some kinds that are bred in the sea fresh water is immediate destruction.

The saline quality of the sea water cannot by any means be admitted as the cause; since, as the monarch abovementioned justly remarked, no fish imbibe any of the sea's saltness with their food or in respiration. The flesh of all the aquatic race is equally fresh, both in the river, and at the saltiest parts of the ocean; the salt of the element in which they live no way mixing with their constitution.

An hypothesis has been framed to account for this phenomenon, from the superior weight of the sea water being much heavier than fresh water, from the great quantity of salt which it contains in a state of solution: so that it is probable it lies with greater force upon the organs of respiration, and gives them their proper and necessary play:—on the other hand, those fish which are used only to fresh water, cannot bear the weight of the saline fluid, and expire in a manner suffocated in the grossness of the strange element.

The reader has already been informed, that the class, of which we are now discoursing, is produced from spawn: the exceptions are few; the eel and the blenny, however, are known to bring forth their young alive.

Bowlher,

Bowlher, who has written expressly on this subject, relates that an eel, which was opened in the presence of respectable witnesses, was found to have an infinite number of little creatures closely wrapped up together in a lump, about the size of a nutmeg, which being put into a bason of water, soon separated and swam about.

In opposition to this it has been suggested, whether these animals may not have worms generated in their bodies; for there are scarcely any fish that are not infested with worms in the same manner.

In what manner impregnation is performed on the eggs of fish, is wholly unknown to us. In ponds, the sexes are often seen together among the long grass at the edge of the water, struggling, and apparently in a state of suffering. They soon afterwards grow thin, lose their appetites, their flesh becomes flabby, their scales become rough, and they lose their lustre. When this period is over, their appetites return, they re-assume their natural agility, and their scales become brilliant and beautiful.

Fish deposit their spawn at different seasons of the year; those which inhabit the depths
of

of the ocean are said to choose the winter months: in general, however, those with which we are acquainted choose the summer season, and prefer such water as is somewhat warmed by the sun-beams. After having deposited their burthen, they return to their former stations, and leave their progeny to shift for themselves.

The cetaceous class nurse their young with constant care, and protect them from every injury; the cartilaginous, though incapable of nursing their offspring, yet defend them with courage and activity: but the heedless and hungry tribe we are now describing leave their spawn without any protection, and forget all connection at their departure.

Yet the production and continuation of their species seems to be the most important business of their lives; and there is no danger which they will not encounter, even to the surmounting precipices, to find a proper place for the deposition of their future offspring.

The productive power of fish exceeds our idea, for it would in a short time outstrip all calculation. A single herring, if suffered to multiply unmolested and undiminished for
twenty

twenty years, would shew a progeny greater in bulk than ten times our globe. But happily the ballance of nature is exactly preserved ; and their consumption is equal to their fecundity. It should seem also that there is something more favourable to the fecundity of fish in the ocean, than in an element less impregnated with salt ; for those of the ocean exceed the inhabitants of lakes and rivers, in point of progeny, in the proportion of twenty to one ; nor do they exceed them less in size and strength. Indeed it is obvious that, in fresh water, fish abate much of their courage and rapacity ; pursue each other with less violence, and seem to be less powerfully actuated by all their appetites.

In the propagation of fish, as indeed in every part of animated nature, some degree of warmth seems absolutely necessary : the spawn is therefore always deposited in those places where the sun-beams may reach them, either at the bottom of shallow shores, or floating on the surface in deep waters. But a small degree of heat answers all the purposes of incubation : and the animal issues into life, *perhaps*, in a state of perfect formation, and never to undergo any succeeding change.

We

We say *perhaps*, because it is not improbable that fish may suffer some slight change after their exclusion from the egg. This change is known to take place in the frog tribe, and many of the lizard kind, which are produced from the egg in an imperfect form. The tadpole, or young frog, with its enormous head and slender tail is well known; a species of the lizard also, which is excluded from the shell without legs, only acquires them by degrees, and it does not put off its serpent form till after some time.

It is a general rule in nature, that the larger the animals are, the longer they continue before exclusion: and this holds good with respect to the pea or spawn of the spinous fish. To assign a cause for this well known truth is not easy: placing probability in the stead of certainty, we might say, that as all large bodies take a longer time to grow hot than small ones, so the larger the egg, the larger influence of vital warmth it requires to reach through all its recesses, and to unfold the dormant springs that wait to be put in motion.

Duhamel remarks to us, that fish are a considerable time in coming to their full growth; and that they are a long time destroyed before
it

it comes to their turn to be destroyers. For with respect to the growth of fish, it is observed that, among carps particularly, they grow to about the size of the leaf of a willow-tree in the first year; at two years they are about four inches long; and seven after the fifth. From that time to eight years old, they are found to be large in proportion to the goodness of the pond, and generally from eight to twelve inches in length.

With regard to sea-fish the same authority, strengthened by that of fishermen, assures us, that a fish must be six years old before it is fit to be served up to table. They adduce as an instance the growth of a mackerel; and assure us, that those a year old are as large as one's finger; that those of two years are twice that length; at three and four years they are that small kind of mackerel that have neither melts nor roes; and between five and six they are those full-grown fish that are served up at our tables.

In the same manner with regard to flat-fish, we are told that turbot and barbel at one year are about the size of a crown-piece; the second year they are as large as the palm of one's hand; and in the fifth and sixth years large enough to furnish a handsome dish.

The change of seasons seems to have its influence on fish as well as on other classes of animals: in winter their appetites seem entirely to forsake them; at least they continue in so torpid a state, that few baits will tempt them to their destruction. They then forsake the shallow water, and seek those deep holes that are found in every river, where they continue for a length of time without ever appearing to move. The cold evidently affects them; for they lie close to the bottom, where the water is most warm, and seldom venture out, except the day be peculiarly fine, and the shallows at the edge of the stream are warmed by the powerful rays of the sun.

It is asserted by Goldsmith, “that some
“fish may be rendered so torpid by the cold
“in the northern rivers, as to be frozen up in
“the great mass of ice, in which they con-
“tinue for several months together, seem-
“ingly without life or sensation, the prisoners
“of congelation, and waiting the approach of
“a warmer sun, to restore them at once to
“life and liberty.—Thus that chearful lumi-
“nary not only distributes health and vegeta-
“tion to the productions of the earth, but is
“ardently sought even by the gelid inhabit-
“ants of the water.”

Fish,

Fish, like all other created beings are subject to infirmity and disorder. Besides their suffering from intensity of cold, there are certain dispositions in the element in which they reside that are unfavourable to their health and propagation. In some ponds they will not breed, however well situated and supplied with every necessary for their convenience and support. Some seasons are liable to epidemic contagions; and the fish are seen dead by the water side, without any apparent cause.

Among their infirmities we have to notice, that almost every species is infested with worms of different kinds peculiar to itself. When fish are healthy and fat, they are not much annoyed by them; but in winter, and after spawning time, when they are lean and sickly, they are very great sufferers. These vermin lodge themselves either in the jaws, and the intestines internally, or externally near the fins. The great fins abound with them, nor are the little ones entirely free.

It is a fact pretty generally known, that the cataceous and cartilaginous classes of fish bear no proportion in point of number to that of the spinous, of which above four hundred species are already known; so that the number

of the former make not above a fifth part of the finny creation.

From the great variety in this class, the mind must be perplexed and bewildered in describing or remembering even a part of what it contains. Systems have been therefore devised to obviate this inconvenience, and regulate the confusion, by throwing into one group or division several fish that agree in many particulars; and thus enabling the mind to comprehend the whole when offered in larger masses to its consideration.

It has been justly observed that of all animated beings, fish most demand a systematical arrangement: birds, in their respective genera, seldom vary in size; quadrupeds are not so numerous but that they are well known; but no size can discriminate, where the same animal may be ten inches or ten feet in length; something of precision must therefore be adapted to give us the idea of an animal whose history we are pursuing.

Artedi and Linnæus have long stood high as the formers of systems; but systems are always arbitrary, and consequently fluctuating; the last is generally therefore in the highest estimation.

M. Gouan, a naturalist of much celebrity
at

at Montpellier, has been happy enough by a union of those of the two former, to effect an arrangement not only precisely systematical, but in some measure adopted by nature itself. Such a system deserves the attention of every one who wishes to arrange his ideas ; and as such we shall lay the outlines of it before our readers ; though afterwards, in giving a more minute history of the different species, we shall not feel ourselves compelled to deviate from the method already pursued of following the chain of nature.

M. Gouan has so far adopted this method in regard to the spinous class, that he has arranged them under the two general divisions of prickly-finned fish, and soft-finned fish.

For the subdivisions, he has in conformity to the observations of Linnæus, attended to the situation of the fins.

The ventral or belly fins, which are those particularly to be remarked, are either wholly wanting, as in the eel, and then the fish is called *apodal*.

The ventral fins are placed more forward than the pectoral fins, as in the haddock, and then it is called a *jugular fish*.

The ventral fins are placed directly under
the

the pectoral fins, as in the father-lasher, and then it becomes a *thoracic fish*.

Lastly, the ventral fins are placed nearer the tail than the pectoral fins, as in the minnow, and then it is an *abdominal-fish*.

These characters are strongly marked, and may be easily remembered, and of these the French naturalist has formed two grand divisions, which he arranges as follow:

FIRST DIVISION:

PRICKLY-FINNED FISH.

1. Prickly-finned Apodal Fish; those wanting the ventral fins.
2. Prickly-finned Jugular Fish; ventral fins more forward than the pectoral.
3. Prickly-finned Thoracic Fish; ventral fins directly under the pectoral.
4. Prickly-finned Abdominal Fish; ventral fins nearer the tail than the pectoral.

SECOND DIVISION:

SOFT-FINNED FISH.

1. Soft-finned Apodal Fish; characterised as the foregoing first sub-division.
2. Soft-finned Jugular Fish; corresponding as above:—and so of the rest.
3. Prickly-finned Thoracic Fish.
4. Soft-finned Abdominal Fish.

It

It now remains, after a few preliminary observations, to divide the preceding arrangement into such tribes as are most strongly marked by nature, and by giving the distinct characters of each, to make a very complete and very simple system. The young naturalist will hence have a tolerable idea of the FORM of every kind of spinous fish; but the history and nature of the animal itself can be obtained only from experience and observation.

To explain the nature of his system, and render the utility of it more apparent, M. Gouan gives the following examples:—"Suppose, says he, I meet with a fish, the name to me unknown, of which I desire to know something more. The way is, first to see whether it be a cartilaginous fish, which may be known by its wanting fins to open and shut the gills, which the cartilaginous kind are wholly without. If I find that it has them, then it is a spinous fish; and, in order to know its kind, I examine its fins, whether they be prickly or soft; I find them soft; it is therefore to be ranked among the soft-finned fish. I next examine its ventral, or belly-fins, and finding that the fish has them, I look for their situation, and find they are nearer to the tail

tail than to the pectoral fins. By this I find the animal to be a soft-finned abdominal fish. Then to know which of the kinds of these fish it is, I examine its figure and the shape of its head. I find the body rather oblong; the head with a small beak; the lower jaw like a saw; the fin covering the gills with eight rays. This animal must therefore be the herring, or one of that family; such as the pilchard, the sprat, the shad, or the anchovy.

“ To give another instance; upon examining the fins of a fish to me unknown, I find them prickly; I then look for the situation of the ventral fins; I find them entirely wanting: this, then, must be a prickly-finned apodal fish. Of this kind there are but three, and, by comparing the fish with the description, I find either the trichurus kind, the sword-fish, or the gilt-head. Upon examining also its internal structure, I shall find a very great similitude between my fish and that placed at the head of the family.

DIVISION I.

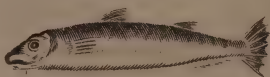
PRICKLY-FINNED FISH.

SECT. I.—PRICKLY-FINNED APODAL FISH.

1. The *Trichurus*. The body of this fish is of a sword-like form; the head oblong; the
the



Saw Fish FIG. 102.



Mackrell FIG. 105.



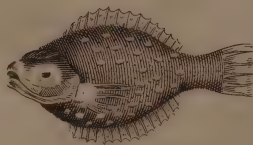
Gudgeon FIG. 103.



Sword Fish FIG. 101.



Tunny FIG. 106.



Turbot FIG. 104.

the teeth sword-like, bearded at the points; the foreteeth largest; the fins covering the gills; have seven spines; the tail ending in a point without fins.

This fish is of a beautiful silvery white, is found about the shores of India, and particularly near China, where it will leap into the fishermens' baskets. It is also found in some parts of America.

2. The *Xiphias* or *Sword-fish*. The body is round, the head long, the upper jaw terminating by a long beak in form of a sword, and the fins that cover the gills have six spines.

3. The *Dorada*, *Gilt-head*, or *Ophidium*, and by sailors called the *Dolphin*. The body sword-like; the head blunt; the fin covering the gill with seven spines; the mouth opens sideways; the fins of the back, the anus, and tail, all joining together.

SECT. II.—PRICKLY-FINNED JUGULAR-FISH.

4. The *Trechinus*, or *Weaver*. The body is oblong, the head obtuse; the bones covering the gills jagged at the bottom; the fins covering the gills with six spines; the anus near the breast. The fish buries itself in the sands, leaving only its nose out; and if trodden upon, immediately strikes with the spines that form its

dorsal fins, which are venomous and dangerous.

5. The *Uranoscopus*. The body is formed like a wedge; the head is almost round, and larger than the body, with eyes on the top of it; the mouth flat; the fin covering the gills with five spines, and the anus in the middle of the body. This fish is chiefly found in the Mediterranean sea.

6. The *Callionomus*, or *Dragonet*. The body is also of the wedge-form; the head is broad, and larger than the body; the mouth even with the body; the upper lip doubled up; the bony covering of the gills shut close; the opening to which is behind the head; the fin that covers the gills has six spines. It is an inhabitant of the Atlantic.

7. The *Blennius*, or *Blenny*; one species of which is of the viviparous kind. The body is oblong; the head slanting or declining to one side; the teeth a single range; the gills covered with a fin consisting of six spines; and the ventral fins having two small blunt bones in each.

SECT. III. PRICKLY-FINNED THORACIC FISH.

8. The *Gobius*, or *Gudgeon*. The body round and oblong; the head with two little holes

holes between the eyes, one before the other; the fin covering the gill with six spines; the ventral fins joined together. The Gudgeon, as well as the *Cotcus*, or *Bull-head*, is usually placed under the head *Cyprinus*.

9. The *Cepola*. The body sword-like; the head blunt; the mouth flat; the fin covering the gills with six spines; the fins distinct; an inhabitant of the Mediterranean Sea.

10. The *Coryphæna*, or *Razor-fish*. The body wedge-like; the head very bevel; the fin covering the gills with five spines.

11. The *Scomber*, or *Mackerel*. The body oblong; the line running down the side zig-zagged towards the tail; the head sharp and small; the fins covering the gills with six spines; several fins towards the tail.

12. The *Labrus*, or *Wrasse*. The body oval; the head middling; the lips doubled inward; both cutting and grinding teeth; the covers of the gills scaly; the fin covering the gills with five spines; the pectoral fins pointed.

13. The *Sparus*, or *Sea-bream*. The body oblong; the head middling; the lips not inverted; the teeth cutting and grinding; the cover of the gills scaly; the fins covering

the gills with five rays; the pectoral fins pointed.

14. The *Chætodon*, or *Cat-fish*. The body oblong; the head small; teeth slender and bending; the fins covering the gills with five or six spines; the fins of the back and anus scaly.

15. The *Sciæna*. The body nearly elliptical; the head bevel; the covers of the fins scaly; the fin covering the gills with six rays; the fins of the back jagged, and hidden in a furrow in the back.

16. The *Perch*. The body oblong; the head bevel; the covers of the gills scaly and toothed; the fin covering the gills with seven spines; the fins in some jagged.

17. The *Scorpaëna*, or *Father-lasher*. The body oblong; the head great, with beards; the covers of the gills armed with prickles; the fin covering the gills with seven spines.

18. The *Mullus*, or *Surmulet*. The body slender; the head almost four-cornered; the fin covering the gills with three spines; some of these have beards; a fish highly prized by the Romans, and still considered as a very great delicacy.

19. The *Trigla*, or the *Gurnard*. The body slender; the head nearly four-cornered, and covered



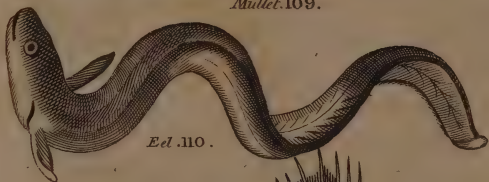
Perch FIG. 107.



Lamprey. III.



Mullet. 109.



Eel. 110.



John Doree. 108.

covered with a bony coat; the fin covering the gills with seven spines; the pectoral and ventral fins, strengthened with additional muscles and bones, and very large for the animal's size.

20. The *Cottus*, or *Bull-head*. The body wedge-like; the head flat and broader than the body; the fin covering the gills with six spines; the head furnished with prickles, knobs, and beards.

21. The *Zeus* or *Doree*. The body oblong; the head large, and bevel; the fin covering the gills with seven rays; the fins jagged; the upper jaw with a loose floating skin depending into the mouth.

22. The *Trachipterus*, or *Sabre*. The body sword-like; the head bevel; the fin covering the gills with six spines; the lateral line straight; the scales in a single order; a loose skin in both the jaws.

23. The *Gasterosteus*, or *Stickleback*. The body broadest towards the tail; the head oblong; the fin covering the gills with three spines; prickles starting backward before the back fins and the fins of the anus.

PRICKLY-FINNED ABDOMINAL FISH.

The *Silurus*, or *Sheat-Fish*. The body oblong; the head large; the fin covering the gills

gills with from four to fourteen spines; the leading bones or spines in the back and pectoral fins toothed.

25. The *Mugil*, or *Mullet*. The body oblong; the head almost conical; the upper jaw with a furrow, which receives the prominence of the under; the fin covering the gills with seven rays.

26. The *Polynemus*. The body oblong; the head with a beak; the fin covering the gills with from five to seven spines: the bones that move the pectoral fins not articulated to those fins. This would seem rather to be a species of the *Exocetas*: as will appear afterwards in the particular description of the Flying-fish.

27. The *Theutys*. The body almost elliptical; the head abruptly shortened; the fin covering the gills with five rays; the teeth in a single row, close, strong, and even.

28. The *Elops*, or *Sea-serpent*. The body slender; the head large; the fin covering the gills double with thirty spines, and armed externally with five bones resembling teeth.

DIVISION II.

SOFT-FINNED FISH.

SECT. I.—SOFT-FINNED APODAL FISH.

29. The *Muræna*, or *Eel*. The body round and slender; the head terminating in a beak; the fin covering the gills with ten rays; the opening to the gills pipe-fashion, placed near the pectoral fins; the fins of the back, the anus, and the tail, united in one.

30. The *Gymnotus*, or *Carapo*. The body broadest on the back, like the blade of a knife; the head small; the fin covering the gills with five rays; the back without a fin; two beards or filaments from the upper lip; an inhabitant of Brasil.

31. The *Anarhicas*, or *Wolf-fish*. The body roundish and slender; the head large and blunt; the fore-teeth above and below conical; the grinding teeth and those in the palate round; the fin covering the gill has six rays.

32. The *Stromateus*. The body oblong; the head small; the teeth moderately sharp; the fin covering the gill with five or six rays.

33. The *Ammodytes*, or *Launce*. The body slender and roundish; the head terminated by a beak; the teeth of a hair-like fineness: the fin covering the gills with seven rays.

SECT.

SECT. II.—SOFT-FINNED JUGULAR FISH.

34. The *Lapadogaster*. The body wedge-like; the head oblong, forwarder than the body, flattish, the beak resembling that of a duck; the pectoral fins double, two on each side; the ventral joined together; a kind of bony breast-plate between the pectoral fins; the fin covering the gills with five rays; the opening to the gills pipe-fashion.

35. The *Gadus*, or *Cod-fish*. The body oblong; the head wedge-like; the fin covering the gills with seven rays: several back and anal fins.

SECT. III.—SOFT-FINNED THORACIC FISH.

36. The *Plemonecles*, or *Flumide*. The body elliptical; the head small; both eyes on one side of the head; the fin covering the gills with from four to seven rays.

37. The *Echeneic*, or *Sucking-fish*. The body almost wedge-like, moderately round; the head broader than the body; the fin covering the gills with ten rays; an oval breast-plate, streaked in form of a ladder, toothed.

38. The *Lipidopus*, or the *Garter-fish*. The body sword-like: the head lengthened out, the fins covering the gills with seven rays; three scales only on the whole body; two in the place
of

of the ventral fins; the third from that of the anus.

SOFT-FINNED ABDOMINAL FISH.

39. The *Loricaria*. The body crusted over; the head broad, with a beak; no teeth; the fin covering the gills with six rays.

40. The *Atherina*, or *Atherine*. The body oblong; the head of a middling size; the lips indented; the fin covering the gills with six rays; the lines on the sides resembling a silver band.

41. The *Salmo*, or *Salmon*. The body oblong; the head a little sharp; the fin covering the gills with from four to ten rays; the last fin on the back without its correspondent muscles, fat.

42. The *Fistularia*. The body angular, in form of a spindle; the head pipe-fashion, with a beak; the fin covering the gills with seven rays; the under jaw covering the upper.

43. The *Esox*, or *Pike*. The body round; the head with a beak; the under jaw pierced longitudinally with small holes; the fin covering the gills with from seven to twelve rays.

44. The *Argentina*, or *Argentine*. The body a little round and slender; the head with a

beak, broader than the body ; the fin covering the gills with eight rays ; a spurious back fin.

45. The *Clupea*, or *Herring*. The body a little oblong ; the head with a small beak ; the fin covering the gills with eight rays.

46. The *Evocetas*, or *Flying-fish*. The body oblong ; the head almost three-cornered ; the fin covering the gills with ten rays ; the pectoral fins placed high, and as long as the whole body ; the back fin at the extremity of the back.

47. The *Cyprinus*, or *Carp*. The body elongated, almost round ; the head with a small beak ; the hinder part of the head covering the gills, marked with a crescent ; the fin covering the gills with three rays.

48. The *Cobitis*, or *Loach*. The body oblong : almost equally broad throughout ; the head small, a little elongated ; the eyes in the hinder part of the head ; the fin covering the gills with from four to six rays ; the covers of the gills closed below.

49. The *Amia*, or *Bonito*. The body round and slender : the head, forehead, and breast, without skin ; the fin covering the gills with twelve rays ; two beards from the nose.

50. The

50. The *Mormyrus*. The body oblong; the head lengthened; the gill covering fin has a single ray; the opening to the gills is linear, and has no bone covering them.

Having given this copious view of Gouan's system, for the convenience of those who may wish to make ichthyology a science, we shall conclude with a definition of two very important words, frequently made use of by naturalists of every class.

GENUS, in natural history, is a subdivision of any class or order of natural beings, whether of the animal, vegetable, or mineral kingdoms, all agreeing in certain common characters.

The genera of animals ought to be established upon the most natural, obvious, and distinctive characters. The genera of fish are founded on a certain agreement between a number of species, arising from the similitude of their essential external parts, which always consists in the situation of these parts, for the most part also in number, and frequently in their figure and proportion.

The word SPECIES has been very accurately defined by Artedi, in the science of ichthyology—"Every fish, says he, which differs from

from all the other fish of the same genus, in some external part, whether that difference be in excess or defect, in number or proportion, or even in colour, provided that the difference be fixed and invariable, is properly to be called a distinct species."

The specific differences of fish are to be drawn from these circumstances; but it is not to be supposed that every species differs in all of them; sometimes only one, sometimes more, occasion the variation.

If any one fish, in regard to all the others of the same genus, be found to be possessed of some external part which they all want, as for example, if it have tubercles in the shape of horns on the head, spines or prickles in the head, or any other part of the body, the fish is then to be esteemed a distinct species.

If one fish differ from the others of the same genus, in the number of any parts, as fins, spines, or tubercles, it is then also a distinct species.

If one fish differ from another in the proportion of any essential part, as in the having longer jaws, longer teeth, or the like, it is also to be esteemed a truly different species.

If one fish differ from another in the figure of some essential part, as if the snout, the
back,

back, the teeth, or the tail, or the lateral lines, it is to be esteemed a distinct species.

If one fish differ from another of the same genus in the excess of parts, having some part that is deficient in the other; or if in number, proportion, or figure of some of the essential parts, the distinction will be the more evident as the greater number of parts differ, and the species will be easily found to be distinct.

With this elementary assistance to the scientific knowledge of fish, we now proceed to the history of such individuals as are best known and ascertained.

THE XIPHIAS, OR SWORD FISH.

THIS fish is from fifteen to twenty-five feet long, and very thick in proportion to its length: it is found in most parts that are frequented by whales, to which it is a most terrible enemy. Navigators say, that at the sight

sight of this animal, the whale seems agitated in an extraordinary manner, leaping from the water as if from fear: wherever it appears, the whale perceives it at a distance, and flies from it in the opposite direction. The whale has no instrument of defence except its tail, with which it endeavours to strike the enemy, and a single blow taking place would effectually destroy it: but the sword-fish is as active as the other is strong, and easily avoids the stroke; then bounding into the air, it falls upon its enemy, and endeavours not to pierce with its pointed beak, but to cut it with its toothed edges. The surrounding sea is soon dyed with blood, proceeding from the wounds of the whale; while the enormous animal vainly endeavours to reach its invader, and strikes with its tail against the surface of the water, making a report at each blow, louder than the noise of a cannon.*

* This fish is to be found equally in hot and in frozen climates: it appears in the seas of Spitzbergen, and in those of Africa, of the East Indies, and of America; and every where it is the sworn foe of the whale.

THE DORADA.

THIS is one of the most beautiful, most active, and most voracious of the spinous kind; they are in a state of continual warfare, always employed either in defending themselves against the shark, or darting after the smaller fish. It is chiefly found in the tropical climates, is about six feet long, yet not thicker than a salmon, and, furnished with a full complement of fins, cuts its way through the water with amazing rapidity.—Its eyes are placed on each side of the head, large and beautiful, surrounded with circles of shining gold. The back enamelled all over with spots of a bluish green and silver; the tail and fins of a gold colour, and altogether possessing such a brilliancy of tint as nothing but Nature's pencil could produce.

THE ANARRHICUS LUPUS, OR SEA-WOLF.

THIS seems to be confined to the northern part of the globe. We find it in the sea of Greenland ; in those of Iceland and Norway ; on the coasts of Scotland and of Yorkshire ; and lastly in that part of the German ocean, which washes the shores of Holland ; which last is the most southern of its haunts that we can with any certainty mention.

It is a most ravenous and fierce fish, and when taken, fastens on any thing within its reach : the fishermen, dreading its bite, endeavour, as soon as possible, to beat out its fore teeth, and then kill it by striking it behind the head. Schonevelde relates, that its bite is so hard that it will seize on an anchor, and leave the marks of its teeth in it ; and the Dutch and German names of *Steenbider*, and *Steinbeisser*, express the sense of its great strength, as if it were capable of crushing even stones with its jaws.

It

It feeds almost entirely on crustaceous fish, such as crabs, lobsters, prawns, muscles, scollops, large whelks, &c. these it grinds to pieces with its teeth, and swallows with the lesser shells. It does not appear that they are dissolved in the stomach, but are voided with the fæces; for which purpose the aperture of the anus is wider than in other fish of the same size.

It is full of roe in February, March, and April, and spawns in May and June.

This fish has so disagreeable and horrid an appearance that nobody at Scarborough, except the fishermen, will eat it, and they prefer it to holibut. They always, before dressing, take off the head and skin.

The sea-wolf grows to a large size: those on the Yorkshire coast are sometimes found of the length of four feet; according to Dr. Johnson, they have been taken near Shetland seven feet long, and even more.

The head is a little flatted on the top; the nose blunt; the nostrils very small; the eyes small, and placed near the end of the nose.

The teeth are very remarkable, and finely adapted to its way of life. The fore teeth are strong, conical, diverge a little from each other, stand far out from the jaws, and are

commonly six above and the same below, though sometimes there are only five in each jaw; these are supported within side by a row of lesser teeth, which makes the number in the upper jaw 17 or 18, in the lower 11 or 12.

The sides of the under jaw are convex inwards, which greatly adds to their strength, and at the same time allows room for the large muscles with which the head of this fish is furnished. The *dentes molares*, or grinding teeth of the under jaw, are higher on the outer than the inner edges, which inclines their surfaces inward; they join to the canine teeth in that jaw, but in the upper are separated from them. In the centre there are two rows of flat strong teeth, fixed on an oblong basis upon the bones of the palate and nose. The teeth of the anarrhicus are often found fossil; and in that state called *bifonites*, or *toad-stones*: these were formerly much esteemed for their imaginary virtues, and were set in gold, and worn as rings.

The two bones that form the under jaw are united before by a loose cartilage; which mechanism, admitting of a motion from side to side; most evidently contributes to the design of the whole, viz. a facility of breaking, grinding,
ing,

ing, and comminuting, its testaceous and crustaceous food. At the entrance of the gullet, above and below, are echinated bones : these are very small, being the less necessary, as the food is in a great measure comminuted in the mouth by aid of the grinders.

The body is long, and a little compressed sideways; the skin smooth and slippery; it wants the lateral line. The pectoral fins consist of 18 rays. The dorsal fin extends from the hind part of the head to the tail; the rays in the fresh fish are not visible. The anal fin extends as far as the dorsal fin. The tail is round at its end, and consists of 13 rays. The sides, back, and fins, are of a livid lead colour; the two first marked downwards with irregular obscure dusky lines; these in different fish have different appearances. The young are of a greenish cast, resembling the seawrack, amongst which they reside for some time after their birth.

THE CHAETODON, OR CAT FISH.

THE body is oblong, the head small, the teeth slender, very numerous and flexile; the rays of the gill five or six; the fins of the back and anus scaly.

There are twenty-three species, distinguished from each other principally by the figure of the tail, and the number of spines in the back fin.

The most remarkable is the *rostratus*, or shooting fish, of Linnæus, having a hollow cylindrical beak. The following account of this fish, under a different name, is given by a writer of credit.

The *jaculator*, or darting fish, is an inhabitant of the Indian sea, and derives its name from the extraordinary manner in which it obtains its food.

The fish is of the size of a carp, the body covered with large scales, the head also is scaly, and the lower jaw projects; the eyes are large, and the iris of a golden colour; the whole

whole body is likewise of a golden hue, like that of the carp, except the back, which approaches to a brown, and is marked with five dark brown transverse equi-distant spots on either side, the first at the temples, the last near the tail.

The jaculator frequents the shores and sides of the seas or rivers in quest of food. When he intends to catch a fly, or any other insect which he sees at a distance he approaches very slowly and cautiously, and comes as much as possible perpendicularly under the object; the body being put more or less in an oblique situation, and the mouth and eyes being near the surface of the water, the jaculator remains for a moment quite immoveable, having its eyes fixed directly on the object, and then begins to shoot, without ever shewing its mouth above the surface of the water, out of which a single drop shot at the object seems to arise, which never fails striking the fly into the sea, where it soon becomes the prey of the fish.

This relation is authorized by the experiment of M. *Hommel*, governor of Batavia in 1776, who had curiosity to be convinced of the truth by ocular demonstration. For this purpose he had a large wide tun filled with sea water, then had some of the fish caught
and

and put into it, changing the water every other day. In a short time they seemed reconciled to their confinement. A slender stick with a fly pinned on its end, was placed in such a direction on the side of the vessel, that the fish could strike it. It was with inexpressible delight that the governor saw these fish exercising their skill in shooting at the fly with an amazing velocity, and never missing the mark. With the closest attention he never could see any part of the mouth out of the water, though he often saw the fish shoot a great many drops one after another, without leaving its place and fixed situation.

THE CALLIONYMOUS.

THE upper lip of this fish is doubled up; the eyes are very near each other; and the belly fins at a great distance.

There are three species of callionymous.

1. The *lyra*, with the first bone of the back fin as long as the body of the animal. It is found as far north as Norway and Spitzbergen, and as far south as the Mediterranean Sea; and it is not unfrequent on the Scarborough coast, where it is taken by the hook in thirty or forty fathoms water.

2. The *dranunculus* with the first bone of the back fin shorter than its body, which is of a spotted yellow. It frequents the shores of Genoa and Rome.

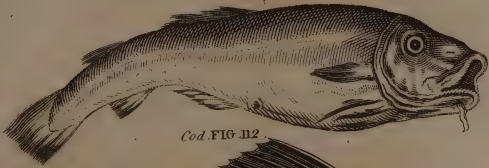
3. The *indicus* has a smooth head with longitudinal wrinkles; the lower jaw is a little longer than the upper one; the body of a livid colour; the anus in the middle of the body. It is a native of Asia.

THE SALMON.

THIS is a soft-finned abdominal fish; and distinguished from others of the truttaceous kind by the following characters; it is of an oblong body covered with very small scales, a small head, a sharp nose, and forked tail; its back is bluish, and the rest of the body reddish; but the belly part is paler, or whitish, and the whole is usually spotted. Its under jaw is bent upward, and sometimes so much so that it makes itself a sinus in the upper by constant motion, and sometimes perforates it.

The salmon is first produced from its parent spawn in fresh rivers; thence it goes into the sea, to acquire its growth and feed; and at the time of its full growth, and in the season for spawning, it removes into the fresh waters again.

People who are accustomed to view salmon, can discover the difference of sex at first sight, from the head of the *he* fish being much larger than



Cod. FIG. 112.



Carp. 115.



Salmon. 113.



Herring. 114.



Flying Fish. 116.



than that of the *she*, and when full grown, the former has a knob on the point of the lower jaw.

In the latter end of the year, the salmon makes as far up the river as possible in order to spawn; and when they meet with a place suitable, the male and female conjunctly form a hole in the sand or gravel, about eighteen inches deep, wherein they cast their sperm together, and carefully cover it over with the same materials, where it continues till the spring, if not disturbed by the winter's flood.—One of the two roes of the *she* fish will at this season be sometimes twelve inches in length, and six in circumference.

It is remarkable, that so far as observation has at any time been able to trace them, the same shoals of salmon always return into the same river out of which they swam, and not into any other; so that the people who live on the salmon fishery are not afraid of their rivers being cleared, by all the fish in them going down into the sea, for they know that they will all return to them again at a proper time.

When the salmon has once entered a fresh river, he always swims up against the stream,
VOL. IV. U and

and often will go a hundred leagues in the large and long rivers; and the people at this vast distance from the mouth have the pleasure of taking a fish that is in part properly of the sea kind. And it is somewhat singular, says *Des Landes*, that the rivers which most abound with salmon, do not make the seas about their mouths any more abound with them than others; for instance, the harbour of Brest affords no salmon, though the river Chateaulin, which discharges itself into it, is the richest salmon river in France.

Neither do salmon equally frequent all rivers, though the rivers themselves may seem to us equally proper for their reception. There are two rivers which open themselves into the harbour of Brest, very near to each other; the one of these is famous for the quantity of salmon in it; and the great advantages thence arising;—in the other, these fish are never seen. The cause most probably of their making this regular choice is, their finding plenty of food, and proper places for depositing their spawn in the one of these rivers, and not in the other.

The depositing the spawn seems one of the most important acts in the life of a salmon; and there is no danger which they will not encounter,

counter, even to the surmounting of precipices, to find a proper place for the purpose: and they not only brave the danger of various enemies, but also spring up cataracts as high as a house.

When they come to the bottom of a torrent, they seem disappointed at meeting the obstruction, and swim some paces back; they then take a view of the danger that lies before them, survey it motionless for some minutes,—advance, and again retreat; till at last summoning up all their force, they take a leap from the bottom; their body straight and strongly in motion, and thus most frequently clear every obstruction.

Another singularity regarding the salmon, is their swimming up the rivers together in such vast numbers. It is to be allowed, indeed, that herring, mackerel, and many other fish, do in the same manner appear on the coast at certain seasons in prodigious numbers; but the reasons for their coming together in these quantities are much more easily explained. The herrings when they come in such prodigious shoals to the coasts of Britain and France, have been found to be allured thither in these numbers by a prodigious quantity of a particular sort of sea worms, which are their favourite food, and which are found to cover the whole surface of the sea at that time.

Rondelletius has described these insects under the name of sea-caterpillars; they always appear in the months of June, July, and August, which are the herring season in those parts of the world; and probably the same cause will be found to bring them to other places, if sufficiently enquired into, as these and some other fish come to certain places in shoals, to get food.—But the salmon do it in order to propagate their species. The spawn of the salmon is never deposited but in the rivers, at the time that these fish are found in the rivers, it is only with this intent: the females go first and the males follow as far as the others please to lead them, which is usually to some convenient place in shallow water, where the spawn, when deposited, is not buried under too great a quantity of water, but has the advantage of a continual warmth from the sun's beams.

About the latter end of March, or beginning of April, the young fry show themselves alive, very small at first, but they gradually arrive at the size of four inches in length and are then termed, (in the North at least) *smouters* or more properly smelts, though destitute of any affinity in colour or shape to that delicate morsel with which a dish of Newcastle salmon is decorated

decorated at the London tables. This young fry hasten to sea with great expedition; for about the middle of May, the rivers where they breed seem to be alive.

About the middle of June in the following season, the earliest of them take the river again, being increased to 12, 14, or 16 inches long, and in the second stage are called *gilses*. Thus they increase in numbers and size till about the middle of July; during which time they are taken in great numbers; the following season they became a well grown salmon.

The popular opinion that the fish, commonly called the salmon-trout, is a young salmon, is generally deemed ill-founded. In the river Tweed they are called whitlings, and are certainly a distinct species of fish, though resembling the salmon in scales, shape, and colour. Their flavour, when fresh taken, is very delicious, and much superior to all other trout, without exception. They are thought to be peculiar to the main body of the Tweed, and not generating in, or frequenting its branches*.

* They are also caught in Loch Leven, in Fifeshire, where the unfortunate Mary Queen of Scots was confined in a castle built upon a small island in the middle of it. They are of excellent flavour, and the right of fishing for them is farmed out to an individual at a considerable price.

There

There is also in the Tweed, another kind of trout, called the *bull-trout*, of a large size, and proportionably longer than the whitling. This trout is found only in the months of January and February; it often weighs twelve pounds; and is sold in London, during these early months, for salmon.

Another species of small fish is found in those rivers that abound in salmon, and is commonly known by the name of Par-fish. They appear in the month of April, and continue till November, during which time they increase from two or three inches to five or six. They are caught with worms, or the artificial fly. They are most probably the same fish with the *Samlett* of the Wye, and the *Samson* of the Severn, both of which they resemble perfectly in shape and colour; and the same notion prevails in respect to them as of the par, that they are only of the male sex.

But the opinion of their being the fry of the salmon, or else an abortive production of that fish which does not breed, seems to be clearly negatived by Mr. Pennant; and to this may be added, that near the river of Aber, in Carnarvonshire, a small stream falls perpendicularly from a rock 300 feet high: above this fall, the fish called par, samlet, or samson, are in great plenty, but no salmon was ever seen
above

above the cataract; consequently the species in question, which are extremely numerous, and constantly breed there, cannot be either the *abortive*, or *mature* offspring of that fish.

The scarcity of salmon which has of late years prevailed in Worcester, has been attributed to fly-fishing; for they were in such quantities formerly, that there are many old indentures now in Worcester, by which it is covenanted that apprentices shall not be compelled to eat salmon more than twice a week, as is now the case with the ploughmen in Devonshire, and the fishermen's boys in North Shields.

CAPELAR.

THIS fish is described by Walcott under the name of *Salmo Arcticus*. It swarms, he says, on the coasts of Newfoundland, Greenland, and Iceland; lives mostly at sea, and comes into bays

bays only in the months of May, June, and July, to breed. The females enter first, and deposit their roe on the sea-plants. The male follow to milt. At this time the number is so great, that they make the water look black and curled. They are taken by dipping small nets fastened to a hoop at the end of a pole. When fresh caught they have the smell of a cucumber. At Newfoundland they are called *capelan*, and are preserved in brine, as baits for the cod fishery; in Iceland, *Lodua*, and in Greenland, *angmarset*, where they dry them on the rocks, and make them supply the place of bread.

The head of this fish is small; the lower jaw longest; body slender; the lateral line formed by a ridge of short bristles; the gill covers black; back, a dull green; sides and belly silvery white, dotted with black; the belly often tinged with violet; first dorsal fin is in the middle of the back; the second broad and truncated at top; pectoral fins large, and situated very low; tail forked; length six inches. The female wants the black on the gill covers; and the lateral line is smooth.

From the appellation given to it by Mr. Walcott, we have given it place next to the salmon.

THE TUNNY.

THE Tunny is often known by the name of the Spanish Mackerel ; its technical name is *thynnus* ; it is common in the Mediterranean and other seas, but is not frequently caught on the English coast.

The tunny is a very large fish, growing sometimes to seven or eight feet long, and more than a hundred weight. It is of a rounded and thick body, growing gradually small towards the tail, and becoming at last extremely slender. It very much resembles the *pelamis* in its whole figure, but that it wants the oblong black streaks which that fish has on its sides, and is much larger. The back is black, or, if held in some lights, of a shining bluish or greenish hue : the belly, and half the sides, of a silvery whiteness ; the scales are very small ; the snout pointed ; the jaws both of equal length, and armed each with

VOL. IV. X one

one row of teeth. The mouth is large and black within, except part of the palate which is red. The eyes are large ; the larger black fins are two in number, the foremost placed near the head, and rising out of a cavity in the back, and the other at a small distance behind that ; and in some fish of this species, of a reddish, or yellowish colour : behind this last there are eight, nine, or ten small fins running down the ridge of the back, at equal distances, to the tail, which is very forked. The fins at the gills are black, small, and terminate in a point. The belly-fins are placed at a small distance only behind these, and are also small ; and both these and the gill-fins have sinusses in the body of the fish, into which they may be depressed.

Behind the anus is a fin like that on the back, and behind it eight more small ones, answering to those on the back also ; and the skin of the sides near the tail is extended into two fins, so that this part of the fish looks as if it were square.

This fish is much esteemed at the table, especially in Spain and Italy, where it is salted in vast quantities.

Mr. Swinburn, in his Travels through Italy, gives the following remarks on these fish, and the method of taking them :

“ The

“The nets,” says he, “are spread over
“a large space of sea, by means of cables
“fastened to anchors, and are divided into
“several compartments. The entrance is al-
“ways directed, according to the season,
“towards the part of the sea from which the
“fish are known to come. A man placed
“upon the summit of a rock, high above the
“water, gives the signal of the fish being ar-
“rived; for he can discern from that eleva-
“tion what passes under water infinitely
“better than any person nearer the surface.
“As soon as notice is given that the shoal of
“fish has penetrated as far as the inner com-
“partment, or the chamber of death, the
“passage is drawn close, and the slaughter
“begins.

“The tunny belongs to Linnæus’s scomber
“among the thoracici; and enters the Mediter-
“ranean about the vernal equinox, travelling
“in a triangular phalanx, so as to cut the
“waters with its point, and to present an ex-
“tensive base for the tides and the currents to
“set against, and impel forwards. These fish
“repair to the warm seas of Greece to spawn,
“steering their course thither along the Eu-
“ropean shores; but, as they return, ap-
X 2 “proach

“ proach the African coast ; the young fry is
“ placed in the van of the squadron as they
“ travel. They come back from the East in
“ May, and abound on the coast of Sicily
“ and Calabria about that time.

“ In autumn they steer northward, and fre-
“ quent the neighbourhood of Almisì and Na-
“ ples ; but during the whole season strag-
“ glers are occasionally caught. When taken
“ in May, they are full of spawn, and their
“ flesh is then esteemed unwholesome, apt
“ to occasion headaches and vapours ; the
“ milts and roes are particularly so at that
“ season. To prevent these bad effects, the
“ natives fry them in oil, and afterwards salt
“ them. The quantity of these fish consum-
“ ed annually in the two Sicilies almost ex-
“ ceeds the bounds of calculation. From the
“ beginning of May to the end of October it
“ is eaten fresh, and all the rest of the year it
“ is in use salted. The most delicate part is
“ the muzzle. The belly salted was called
“ *tarantellum*, and accounted a great delicacy
“ by the Romans ; its present name is *surra*.
“ The rest of the body is cut into slices, and
“ put into tubs.”

THE COD.

THIS is the largest of a genus of fish, named by some authors *Asselli*, and by others *Gadus*. The chief characters by which the cod is distinguished are as follows:

The colour on the back and sides is a dusky olive, variegated with yellow spots; its belly is white: its sides have a long white line running their whole length, from the gills to the tail, which at the abdomen is curved, but elsewhere is straight; its scales are very small, and adhere firmly to the skin; its eyes are large; at the angle of the lower jaw, there hangs a single beard, which is short, seldom exceeding a finger's length; its tongue is broad; it has several rows of teeth like the pike; and in the palate, near the orifice of the stomach, and near the gills, it has small clusters of teeth. It has three back fins, two at the gills, and two at the breast, and two others behind the anus; and the tail is plain.

The

The cod may not improperly be placed at the head of the migrating or wandering tribe of fish. It is a native of the Northern world, and its places of residence are the banks of Newfoundland, and the other sand-banks that lie off Cape Breton; which, together, form an extensive flat of above five hundred miles in extent, and surrounded by a deep sea. Thither they repair annually in numbers beyond the power of calculation, to feed on the quantity of worms that are to be found there in the sandy bottom. On these banks they are taken in such numbers, that they supply all Europe with a considerable share of provisions. The fishermen take them with their line, as fast as they can throw it; and have stages erected all along the shore for salting and drying them. The best, largest, and fattest cod, are those taken on the South-side of the great bank, which is a kind of submarine mountain, one hundred and fifty leagues long; those on the North-side are much smaller.

The immense captures of cod fish at Newfoundland make but a small diminution, when compared to their numbers; and when their provision is exhausted there, or the season for propagation returns, they go off to the

the polar seas, where they deposit their spawn in full security: whence again want of food forces them, as soon as the first more southern seas are open, to repair southward for subsistence. Nor is this fish an unfrequent visitor upon our own shores; but the returns are not so regular, nor do the captures bear any proportion to those at Newfoundland.

The *Haddock* is a species of the *Gadus*, or Cod, with a bearded mouth, and three fins on the back; the upper jaw longest, and the tail a little forked.

The *Whiting* is another species of the cod, but without a beard.—Both these species are frequent in our seas, and much esteemed at our tables.

The haddock and the whiting are perhaps driven upon our shores rather by their fears than by their appetites. Their migrations; however, are regularly conducted, and their appearance perfectly constant.

THE CLUPEA, OR HERRING.

THE body of this fish is oblong ; the head has a small beak ; the gill-covering fin has eight rays ; the belly fins frequently nine rays ; and a scaly serrated line runs along the body from head to tail. There are eleven species.

1. The *Common Herring* has no spots, and the under jaw is longer than the upper one.— This fish was unknown to the ancients, as it is seldom, if ever, found Southwards. A herring dies immediately after it is taken out of the water ; for this reason, perhaps, they are incomparably better when dressed as soon as caught, than on the following day.

Herrings are found in the highest northern latitudes yet known, and at the same time as low as the northern coasts of France, beyond which they are rarely seen. On the American coast they are met with in vast shoals as low as Carolina ; and such is the annual inundation of them in Chessa-peak, that they become absolutely a nuisance:
they

they are also found in the seas of Kamtschatka, and probably they reach Japan. But their great rendezvous is within the arctic circle, where they continue for months to recruit themselves after the fatigue of spawning; the seas within that space swarming with insect food in a far greater degree than that of our warmer latitudes.

The immense shoals that visit our coasts put themselves in motion in the spring, and begin to appear off the Shetland islands in April and May; yet these are only the fore-runners of the *grand army*, (so the Dutch denominate them) that come in June, and whose extent is such as to alter the very appearance of the ocean: this body being usually divided into distinct columns, of five or six miles in length, and three or four in breadth. In fine weather they reflect a variety of splendid colours like a field of variegated gems; sometimes driving the waters before them with a kind of rippling noise—sometimes sinking for the space of ten or fifteen minutes, and then rising again to the surface.

The herrings are full of roe at the time they arrive upon our coasts, and continue in perfection till the beginning of winter, when they deposit their spawn. The young herrings begin

VOL. IV. Y to

to approach the shores in July and August, and are then from half an inch to two inches long. Some of the old herring continue on our coast the whole year; but the numbers that remain admit of no comparison with those that return: the young ones also are said to pursue the same course, and return to their parental haunts beneath the ice, to repair the destruction of their race made during the summer, and to obtain a safe retreat from their numerous enemies.

But the immediate cause of migration is variously accounted for: *Leuwenhoeck* says, that the Channel every year teems with an innumerable quantity of worms, and little fish, on which the herrings feed; that they are a kind of *manna*, which these fish come punctually to gather up: and when they have entirely cleared the seas in the Northern parts of Europe, they descend towards the South where they are invited by a new stock of provisions. *Anderson* is of opinion that they would never depart from their most desirable retreat in their icy, northern intrenchments, did not their numbers render it necessary for them to migrate; and like bees from a hive, they are compelled to seek for other retreats.

Another

Another opinion is, that they remove for the sake of depositing their spawn in warmer seas, that will mature and vivify it more assuredly than those of the frozen zone. Deficiency of food cannot be so certainly the motive, as they come to us full of fat, and on their return are almost universally observed to be lean and miserable. What their food is near the Pole, we are not informed ; but, in our seas, they feed much on crustaceous insects, and sometimes on their own fry,

This partial migration, viewed in a moral light, must excite our veneration and awe for that Mighty Power which originally impressed those creatures with an instinct that tends to bless and enrich these islands ; and which causes them at certain and invariable times to quit the vast polar deeps, and offer themselves to our expecting fleets,

On their first irruption from their Northern hives, they are surrounded by innumerable enemies, all uniting in their destruction : numerous flocks of the polar sea-fowls watch the outset of their migration, and spread extensive ruin ; the fin-fish, the cachalot, the porpesse, the grampus, and the shark, find them an easy prey, and thin their squadrons by millions, and

from these depredators they have no other means of safety than crowding close together, and leaving the outmost bands the danger of being first devoured ; or by approaching the first shores they can find, which, to the squadron holding an eastern course, is Iceland, where they cover an extent of shore not less than the island itself.

The first opposition met with in their journey southward, is from the Shetland isles, which divide the eastern army again into two parts, and where the fishermen, prepared for their reception, take sometimes two thousand barrels at a single draught. Hence they pass the Western shores of Britain ; and fill every bay and creek with their numbers : others advance towards Yarmouth, the great and ancient mart of herrings ; and pressing through the British channel, in a great degree disappear. From the Shetland isles, and after visiting the Hebrides, a body proceeds to the north of Ireland, to feed and rejoice the inhabitants of most of the coasts that border on the Irish sea. But those brigades, as we may call them, thus separated from the greater columns, are often capricious in their motions, and do not shew an invariable attachment to their haunts.

Indeed

Indeed it appears from one circumstance that these creatures are governed by a choice in respect of the shores they pitch upon : or that having fixed upon a shore, they will frequent it for several seasons, or indeed for several ages, and then most capriciously forsake it. For some ages the shores of Norway were the resort for herrings, as the banks of Newfoundland are for cod ; and thousands of European ships resorted thither. But some short time previously to the year 1600, they forsook the Norwegian coasts, and made the shores of Germany their annual resort, where the Hansetowns derived much advantage from their capture and sale. For above a century, however, their greatest colonies have visited the British channel, and the Irish shores ; though for their apparently capricious desertion it will not be easy to assign a cause. This we may observe, that from the earliest accounts of time, the blessing of their annual visitation has never been withdrawn from the whole, though it may have been denied to particulars.

2. The *Sprat* is a native of the European seas, greatly resembling the herring, though a good deal smaller, and having thirteen rays in the back fin. They are caught in the Thames
from

from the beginning of November till March, and afford very seasonable relief to the poor of the metropolis. They are sometimes pickled, and rendered in flavour scarcely inferior to anchovies; from which they are only to be distinguished by their bones being indissoluble. At Yarmouth they are cured like red herrings.

3. The *Alosa*, or *Shad*, has a forked snout, and black spots on its sides: it frequents the river Thames about the latter end of May, or the beginning of June, and is considered a very coarse and insipid fish. But the Severn affords this fish in very great perfection, and on its first appearance, which is usually in May, or in very warm seasons in April, it is esteemed a delicacy, especially in that part of the river that flows near Gloucester, where they are taken in nets, and often sell dearer than salmon. The London fishmongers distinguish the Severn from the Thames shad, by calling the former *alose*. The old fish come from the sea into the river in full roe, but where they spawn is not determined, for their fry has not yet been ascertained. The Severn shad is sometimes, though rarely, caught in the Thames, and is called by the fishermen *al'is*, (properly *alose*). They continue in the Severn about two months, and
are

are succeeded by a variety called the *twaite*, which is taken in great numbers, but held in as little regard as the shad of the Thames. The chief difference between these varieties is, that the *twaite* has three or four black spots on the sides, placed one under the other: if only one spot, it is always near the gill. The weight of the shad is seldom less than four pounds; that of the *twaite* never exceeds two. Ancient naturalists say, that the shad is a fish of passage in the Nile; that it is also found in the Mediterranean, near Smyrna, and on the coast of Egypt, near Rosetta; and that in the months of December and January it ascends the Nile as high as Cairo, where the people stuff it with pot-marjoram; and when dressed in that manner, it will nearly intoxicate the eater.

4. The *Encrasicolus*, or *Anchovy*, is about three inches long, and has its upper jaw longer than the under. They are taken in vast quantities in the Mediterranean, and are brought over here pickled. The great fishery is at Georgia, a small isle westward of Leghorn.

Mr. Walcott describes the anchovy as follows:—"The nose," says he, "is pointed; edge of the jaws finely serrated; eyes large; body round and slender; back of a dusky green

“ green colour ; sides and belly of a silvery
 “ white ; between the ventral fins a long point-
 “ ed scale ; tail forked ; length six inches and
 “ a half.

“ At different seasons it frequents the At-
 “ lantic ocean and the Mediterranean sea ; pas-
 “ sing through the Straights of Gibraltar to-
 “ wards the Levant in the months of May,
 “ June, and July. The greatest fishery is at
 “ Gorgona a small west isle of Leghorn, where
 “ they are taken at night in nets, into which
 “ they are allured by lights fixed to the stern
 “ of the vessels. When cured, their heads are
 “ cut off, their gall and guts taken out, and
 “ then salted and packed in barrels ; it scarce
 “ needs be mentioned, that being put on the
 “ fire, they dissolve in almost any liquor : they
 “ are well tasted when fresh.”

5. The *Sineosîs* is very like the common herring, but broader ; it has no teeth, and is a native of China.

6. The *Atherinoides* has a shining line on each side, and small belly-fins ; is a native of Surinam.

7. The *Sima* has yellow fins ; the mouth is flat, the upper jaw very short, and the body of a shining silver colour :—it is a native of Asia.

8. The

8. The *Thrissa*;—9. *Sternicla*;—10. *Mystus*;—11. *Tropica*; these are natives of the Indian hemisphere, but afford little interest or amusement in their particular delineation.

THE CARP.

THE mouth of this fish is toothless; there are three rays in the gills; and the belly-fins have frequently nine rays; the term *cyprinus* is used as a generic name to this fish, of which naturalists have enumerated thirty-one species, principally distinguished by the number of rays in the vent fin.

The carp was introduced into England about the year 1514, by Leonard Maschal, to whom we are likewise indebted for that excellent apple the *pepin*. They are not to be found in Russia, even at this day, and in Sweden they are caught only in the ponds of the nobility. They chiefly abound in the rivers and lakes of Polish Prussia, where they are sometimes taken of a vast size. They are there a great

article of commerce, and sent in well-boats to Sweden and Russia. The merchants purchase them out of the waters of the noblesse of the country, who draw a good revenue from this article. They are also sometimes found in the harbour of Dantzic.

Carp live very long. Gesner relates an instance of one that was near a hundred years old. They also grow to such a size, that authors speak of carp weighing 200 pounds weight, and five feet in length. The carp is a prodigious breeder; its quantity of roe has been found sometimes so great, that when taken out, and weighed against the fish itself, the former has preponderated.

From the spawn of this fish, caviare is made for the Jews, who hold the sturgeon in abhorrence. The carp is extremely cunning, and on that account is sometimes styled the *river-fox*. They will often leap over the nets, and in that manner escape; at other times, they will immerse themselves so deep in the mud as to let the net pass over them. They are also very shy in taking a bait; yet at the spawning time they are so simple as to suffer themselves to be tickled, handled, and caught by any body who will attempt it.

This

This fish is apt to mix its milt with the roe of other fish; whence is produced a spurious breed, as has been observed in the offspring of the carp and tench, which bore the greatest resemblance to the first. The same has also been observed of the carp and bream.

Mr. J. Rheinhold Forster, in the Philosophical Transactions for 1771, Art 37, gives us the following observations on the subject of Carp:—

“In Polish Prussia,” says he, “and many other parts of Germany, the sale of carp constitutes a part of the revenue of the nobility and gentry; so that the proper management of that fish is reduced to a kind of system, founded on the experience of several generations. The author here communicates all the particulars which he has been able to collect from the practice of these experienced breeders and feeders of carp, and from his own observation. He recollects to have seen some of these fish, thus treated and maintained, above a yard long, and 25 pounds weight; but had no opportunity of ascertaining their age. In the pond, however, at Charlottenburg, he adds, a palace belonging to the king of Prussia, I saw more
Z 2 “than

“ than two or three hundred carp, between two
“ and three feet long ; and I was told by the
“ keeper they were between 50 and 60 years
“ standing. They were tame, and came to the
“ shore in order to be fed ; they swallowed
“ with ease a piece of white bread of the size
“ of half a halfpenny roll.”

We shall only add, (not certainly for the gratification of the epicure, but to ascertain a curious fact in natural history, of which we, and possibly others, may have hitherto doubted) the author's testimony concerning the possibility of the carp's not only living for a considerable time out of water, but of its growing fat in its new element. The author has seen the experiment successfully tried, and attended to the whole process, in a nobleman's house where he then resided, in the principality of Anhalt Dessau. “ The fish being taken out of the
“ water, is wrapped up in a large quantity of
“ wet moss, spread on a piece of net, which
“ is then gathered into a purse ; in such a
“ manner, however, as to allow him room to
“ breathe. The net is then plunged into wa-
“ ter, and hung up to the ceiling of a cellar.
“ At first the dipping must be repeated every
“ three or four hours ; but afterwards the carp
“ need

“ need only to be plunged into the water once
“ in about six or seven hours. Bread soaked
“ in milk is first given him in small quantities.
“ In a short time the fish will bear more, and
“ grow under this seemingly unnatural treat-
“ ment.”

Mr. Daines Barrington, in a note confirms part of the preceding account, by mentioning the practice of a certain fishmonger near Clare-market, who, in the winter, frequently exposed a bushel at least of carp and tench for sale, in the same dry vessel, for six or seven hours; many of which were not sold, and yet continued in health though breathing nothing but air, during the time above-mentioned, for several days successively.

The carp is the most valuable of all kinds of fish for the stocking of ponds. It is very quick in its growth, and brings forth the spawn three times a year, so that the increase is very great. The females do not begin to breed till eight or nine years old; so that in breeding-ponds a supply must be kept of carp of that age. The best judges allow, that in stocking a breeding-pond, four males should be allowed to twelve females. The usual growth of a carp is from two to three inches in length in a year; but

but in ponds which receive the fattening of common sewers, they have been known to grow from five inches to eighteen in one year. A feeding pond of one acre in extent, will feed very well 300 carp of three years old, 300 of two years, and 400 of one year old. Carp delight greatly in ponds that have marley sides; they love also clay-ponds well sheltered from the winds, and grown with weeds and long grass at the edges, which they feed upon in the hot months. Carp and tench thrive very fast in ponds and rivers near the sea, where the water is a little brackish; but they are not so well tasted as those which live in fresh water. Grains, blood, chicken-guts, and the like, may at times be thrown into carp-ponds, to help to fatten the fish. To make them grow large and fat, the growth of grass under the water should be encouraged by all means possible. For this purpose, as the water decreases in the summer, the sides of the pond left naked and dry, should be well raked with an iron rake to destroy all the weeds, and cut up the surface of the earth: hay-seed should then be sown plentifully in these places; and more ground prepared in the same manner, as the water falls more and more away. By this means there will be a fine and plentiful

plentiful growth of young grass along the sides of the pond to the water's edge ; and when the rains fill up the pond again, this will be all buried under water, and will make a feeding place for the fish, where they will come early in the morning, and fatten greatly upon what they find there.

The method of fattening carps by castration, is a discovery in epicureanism made by Mr. Tull, famous for his improvements in husbandry ; he communicated the secret to Sir Hans Sloane, in whose presence he performed the operation, by cutting open a carp, and shewing the ovary with its canal, leading into the part called the cloaca. He then performed the operation of castration on a second, by opening the ovary, and filling up the wound with the scrapings of a black hat. The castrated carp being put into water with six live ones, seemed only a little less brisk in swimming. Carp thus mutilated is said to excel the others in delicacy of flavor as much as a capon does a cock, or a fat ox exceeds a bull. The effect of castrating fish seems not improbable from its analogy with what we experience in land animals.

GOLD AND SILVER FISH.

THESE are a species of carp distinguished by the name of *Auratus Cyprinus*; a small fish domesticated by the Chinese, and generally kept for ornament by great people in their courts and gardens. They breed them in small ponds made for the purpose; in basons, and even in procelain vessels.

They were first introduced into England about the year 1691, but were not generally known till 1728; when a great number were brought over, and presented first to Sir Matthew Decker, and by him circulated round the neighbourhood of London, from whence they have been distributed to most parts of the country.

The golden fish is not bigger than our pilchard. The male is of a bright red colour from the top of the head to the middle of the body

body ; the rest is of a gold colour ; but it is so bright and splendid, that the finest gilding according to Father Le Compte, cannot approach it. The female is white ; but its tail and half of its body, resemble the lustre of silver.

Du Halde, however, observes, that a red and white colour are not always the distinguishing marks of the male and female ; but that the females are known by several white spots which are seen round the orifices, which serve them as organs of hearing ; and the males, by having these spots much brighter.

Gold Fish are light and lively ; they love to sport on the surface of the water, soon become familiarised, and may even be accustomed to come and receive their food on sounding a small rattle. Great care is necessary to preserve them ; for they are extremely delicate, and sensible to the least injuries of the air :—a loud noise, such as that of thunder, or a cannon ; a strong smell ; a violent shaking of the vessel, or a single touch, will often destroy them.

These fish live with little nourishment ; those small worms that are engendered in the water, or the earthy particles that are mixed with it, are sufficient for their food. The

Chinese, however, take care, from time to time, to throw into the bason and reservoirs, where they are kept, small balls of paste, which they are very fond of when dissolved ; they give them also lean pork, dried in the sun, and reduced to a fine delicate powder, and sometimes snails : the slime which these insects leave at the bottom of the vessel is a great delicacy for them, and they hasten eagerly to feed on it. In winter they are removed from the court to a warm chamber, where they are generally kept shut up in a porcelain vessel.

In warm countries these fish multiply fast, provided care be taken to collect their spawn, which floats on the water, and which they almost entirely devour. This spawn is put into a particular vessel exposed to the sun, and preserved there until vivified by heat. Goldfish, however, seldom multiply when they are kept in close vases, because they are then too much confined. In order to render them fruitful, they must be put into reservoirs of considerable depth, in some places at least, and which are constantly supplied with fresh water.

At a certain time of the year, (says Grosier, in his description of China,) a prodigious number of barks may be seen in the great river

river Yang-tse-kiang, which go thither to purchase the spawn of these fish. Towards the month of May, the neighbouring inhabitants shut up the river in several places with mats and hurdles, which occupy an extent of almost nine or ten leagues, and they leave only a space in the middle, sufficient for the passage of barks.

The spawn of the fish, which the Chinese can distinguish at first sight, although a stranger could perceive no traces of it in the water, is stopped by these hurdles; the water mixed with spawn is then drawn up, and after it has been put into large vessels, it is sold to merchants who transport it afterwards to every part of the empire. This water is sold by measure, and purchased by those who are desirous of stocking their ponds and reservoirs with fish.

The Gold and Silver Fish, though originally natives of China and Japan, are yet become so well reconciled to our climate, as to thrive and multiply very fast in our ponds and stews. They are also frequently kept in glass bowls, in which we have an opportunity of observing their actions and propensities better than we possibly can in their natural state : nor can any thing be more amusing

than such observations ; the double refractions of the glass and water represent them, when moving, in a changeable variety of dimensions, shades, and colours ; while the two mediums, assisted by the concavo-convex shape of the vessel, magnify and distort them vastly ; not to mention, that the introduction of another element and its inhabitants into our parlours, engages the fancy in a very agreeable manner. And this simple exhibition is as pleasing as the absurd introduction of birds apparently surrounded by the fish, is absurd and unnatural.

Some that delight in these fish have adopted a notion that they need no aliment ; it is true indeed that they will subsist for a long time without any apparent food but what they can collect from pure water frequently changed ; yet they must draw some support from animalcula, and other nourishment supplied by the water ; because, though they seem to eat nothing, yet they frequently void a sort of excrement ; and that they are best pleased with this jejune diet, may easily be confuted, since if you toss them crumbs, they will seize them with great readiness, not to say greediness : however, bread should be given sparingly, lest turning sour, it corrupt the water.

water. They will also feed on the water plant *lemna*, (duck's meat,) and also on small fry.

When they want to move a little, they gently protrude themselves with their pectoral fins ; but it is with their strong muscular tails only that they and all fish shoot along with such inconceivable rapidity. In these vessels, the dying of fish may be observed with accuracy : as soon as the creature sickens, the head sinks lower and lower, till at last it stands as it were upon it ; then getting weaker, and losing all poise, the tail turns over, and at last it floats on the surface of the water, with its belly uppermost. The reason why fish, when dead, swim in this manner, is obvious ; because, when the body is no longer balanced by the fins of the belly, the broad muscular back preponderates by its own gravity, and turns the belly uppermost, as lighter, from its being a cavity, and because it contains the swimming bladders, which contribute to render it buoyant.

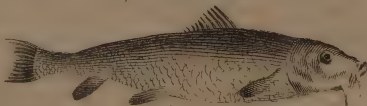
It has been generally said, that the eyes of fish are immoveable ; but these fish apparently turn them forward or backward in their sockets, as their occasions require. They take little notice of a lighted candle, though applied close to their heads, but flounce and
seem

seem much frightened by a sudden stroke of the hand against the support whereon the bowl is hung, especially when they have been motionless, and are perhaps asleep. As fish have no eye-lids, it is not easy to discern when they are sleeping because their eyes are always open.

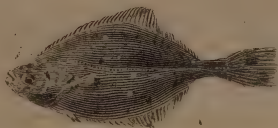
THE BARBEL.

THIS fish belongs to the genus *Cyprinus*; it is about the length of three feet, and will weigh eighteen pounds; the belly white; the dorsal fin is armed with a remarkably strong spine, sharply serrated, with which it can inflict a very severe and dangerous wound on the incautious handler, and even do much damage to nets.

The barbel is so extremely coarse as to have been neglected by the ancients: they are indeed



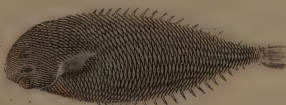
Barbel. FIG. 118.



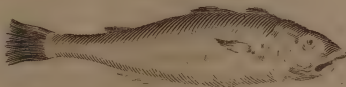
Flounder. 121.



Roach. 117.



Soul. 120.



Whiting. 119.

indeed the worst and coarsest of fresh water fish, and seldom eaten but by the poorer sort of people, who sometimes boil them with a bit of bacon to give them a relish. Their roe is very noxious, affecting those who happen unwarily to eat it with a nausea, vomiting, purging, and a slight swelling.

They frequent the still and deep parts of rivers, and live in society, rooting like swine with their noses in the soft banks. The barbel is so tame as to suffer itself to be caught by the hand; and people have been known to take numbers by diving for them. In summer they move about during night in search of food; but towards autumn, and during winter, confine themselves to the deepest holes.

THE TENCH

IS the English name for the *tinca* of modern authors: according to Artedi, it is a species

cies of the carp. It is thick and bulky in proportion to its length. The colour of the back is dusky : the dorsal and ventral fins of the same colour ; the head, sides, and belly, of a greenish cast, most beautifully mixed with gold, which is in its greatest splendour when the fish is in the highest season. They love still waters, and are rarely found in rivers ; they are very foolish, and easily caught.

The tench is a well-tasted fish, though it lives in foul water, and seems to feed very coarsely. By the ancients it was held in little repute. It is always found in the muddiest parts of ponds, and where there are most weeds.

In this country it is reckoned a wholesome, and even a delicious food ; but the Germans are of a different opinion : they call it in contempt the *shoemaker*. Gesner even says that it is insipid and unwholesome. It does not commonly exceed four or five pounds in weight, though some have been known to weigh ten or twenty.

The slime of the skin of this fish is said to be of a healing nature, and to cure all fresh wounds ; and it is pretended that the other fish know this property in it, and always apply to the tench when wounded. Whether this opinion

nion be true or false, the tench has obtained in consequence of it the name of the *fish's physician*. The pike is said to pay such respect to this fish, on this account, that he never seizes him. But these things are more easily fancied and said, than proved; and, if it be true that the pike does not eat the tench, it may be resolved into a much more natural cause, by supposing the slime of the tench too disagreeable in his stomach to suffer it.

THE CHUB.

THIS fish is of the same genus with the foregoing; it is very coarse and full of bones; frequenting the deep holes of rivers, and in summer commonly lying on the surface, beneath the shade of some tree or bush. Some have been known to weigh eight or nine pounds.

The chub is a very timid fish, sinking to the bottom on the least alarm, even at the passing of a shadow, but they will soon resume their situation. It feeds on worms, caterpillars,

grass-hoppers, and other coleopterous insects that happen to fall into the water; and will even feed on cray-fish. It will rise to a fly.

THE BLEAK.

THIS fish is from two to five or six inches in length; they are very common in many of our rivers, and keep together in large shoals.

During the month of July, (say Goldsmith and Pennant) there appear in the Thames, near Blackwall and Greenwich, innumerable multitudes of small fish, known to the Londoners by the name of *white-bait*. They are esteemed very delicious when fried with fine flour, and occasion during the season, a vast resort of the lower orders of epicures to the taverns at the places where they are taken. There are various suppositions concerning these fish, all of which terminate in reckoning them the fry of some other fish. Mr. Pennant thinks they are of the carp genus, though he cannot positively

positively determine the species to which they belong. They certainly have a greater similarity to the bleak than to any other species ; yet he thinks they cannot be the young fry of that, because the bleak is found in many of the British streams, but the white-bait only in the Thames.

At certain seasons the bleak seems to be in great agonies : they tumble about near the surface of the water, and are incapable of swimming far from the place ; but in about two hours they recover and disappear. Fish thus affected, the Thames fishermen call *mad* bleaks.

They seem also to be so troubled with a species of *gordias*, or hair-worm, that they rise to the surface and die.

THE GUDGEON.

THE body of this fish is round ; the head broader than the body, with two little holes between the eyes, one before the other ; the gill-

membrane with six spines. Of six species, the two chief are,

1. The Gobio, or river bull-head, is very common in all our clear brooks ; it lies almost always at the bottom, or under a stone : it deposits its spawn in a hole which it forms among the gravel, and quits it with great reluctance. It feeds on water insects. Redi says that this fish has no air-bladder. It seldom exceeds the length of three inches and a half. The head is large, broad, flat, and thin at its circumference, being well adapted for insinuating itself under stones: on the middle part of the covers of the gills is a small crooked spine, turning inwards. The eyes are very small ; the irides yellow ; the body grows slender towards the tail, and is very smooth. The colour of this fish is as disagreeable as its form, being dusky, mixed with a dirty yellow ; the belly whitish. The taste, however, is excellent.

2. The Scorpio, or Father-lasher, is not uncommon on the rocky coasts of this island ; it lurks under stones, and will take a bait.— It seldom exceeds eight or nine inches in length. The head is large, and has a most formidable appearance, being armed with vast spines, which it can oppose to any enemy that attacks

attacks it, by swelling out its cheeks and gill-covers to a large size. The nose, and space contiguous to the eyes, are furnished with short sharp spines; the covers of the gills are terminated by exceeding long ones, which are strong, and very sharp. The mouth is large; the jaws covered with very small teeth; the roof of the mouth is furnished with a triangular spot of very minute teeth.

This species is very frequent in the Newfoundland seas, where it is called *scolping*; it is also as common on the coast of Greenland, in deep water near the shore. It forms a principal food of the natives, and the soup made from it is said to be agreeable as well as wholesome.

CORYPHÆNA.

THERE are twelve species of this fish, most of them natives of foreign seas. The general characters are, the head is declined and truncated; the membrane covering the
gills

gills has six rays, and the back fin runs the whole length of the back. The most remarkable are the blue and parrot fish.

The *Blue Fish* is described by Catesby as having its head of a very odd structure, resembling that of the spermaceti whale; the mouth is small; each mandible is armed with a single row of even teeth, so closely joined, that they seem entire bones; the iris of the eye is red. On the back is a long pliant fin, somewhat indented on the edge; behind the gills are two fins, one under the abdomen, and another behind the anus. The tail is forked, and the whole fish entirely blue. They are taken on the coasts of the Bahama islands, and in most of the seas between the tropics.

The *Parrot Fish* has a large mouth, paved at it were with blunt teeth, closely connected, like the sea-wolf. The body is covered with large green scales; the eyes are red and yellow; the upper part of the head brown, the lower part and the gills blue, bordered with a dusky red, a streak of red extends from the throat behind the gills, at the upper end of which is a bright yellow spot. The fins are five in number, one extending almost the length of the back, of a bay or cinnamon colour; there

there are two behind the gills, blended with black, green, and purplish colours, with the upper edge verged with blue; under the anus extends another long narrow green fin, with a list of red through the middle of it; at the basis of the tail on each side is a large narrow spot. The tail is large, forked, and green, with a curved red line running through the middle, parallel to the curve, and ending in two points.

This fish is more esteemed for beauty than for the delicacy of its taste. They are taken on the coasts of Hispaniola, Cuba, and the Bahama islands.

THE EXOCETUS VOLITANS, OR FLYING-FISH.

THIS fish is generally about nine inches long, and full four in circumference at the thickest part. The skin is uncommonly firm, and the scales large and thick. The eye, in consequence of the largeness of the head, is admirably situated for discovering danger, or prey ;

prey ; and when pushed out of the socket, which the fish can do considerably, its sphere of vision is greatly increased.

The wing is no other than a large pectoral fin, composed of seven or eight ribs or pinions, connected by thin membraneous webs, from the root to the very summit. The fore part of the body is fortified just behind the gills by a flat bone on each side, answering all the purposes of clavicles and scapulæ in land animals; and on the posterior part of it, the articulation is made with the wing.

In flying, not only their wings and fins are much expanded, but also their tail ; they skim along the surface of the deep with great velocity, somewhat in the manner of a swallow, but in straight lines; and from the blackness of their backs, the whiteness of their bellies, and forked expanded tails, they have much the same appearance. They fly fifty or sixty yards at one stretch; and repeat the exertion again and again by a momentary touch of the surface, which gives them new vigour for a new departure.

They generally rise in shoals ; and are found in great quantities between lat. 15 and 10 deg. N. and from 20 to 30 W. as also between the tropics in the Atlantic, and in the Indian ocean ; and the

the power of exerting itself in both elements, is said to furnish one of the most entertaining spectacles those seas can exhibit. The efforts to seize on the one side, and the arts of escaping on the other, are perfectly amusing. The shark, the porpoise, the dolphin, and the dorado, are seen upon this occasion, darting after their prey, which will not leave the water, while it has the advantage of swimming, in the beginning of the chase. But, like a hunted hare, being tired at last, it then has recourse to another expedient for safety, by flight. The long fins, which began to grow useless in the water, are now exerted in a different manner, and in a different direction; by this means the timid little animal rises from the water, and flutters over its surface, for sixty or seventy yards, till the muscles, employed in moving the wings, are enfeebled by that particular manner of exertion, and the fish is obliged to immerge into its own element. In a short time, however, they acquire a fresh power of renewing their efforts in the water, and the animal is capable of proceeding with some velocity by swimming. But still the active enemy keeps it in view, and drives it again from the deep; till, at length, the

poor little creature is seen to dart to shorter distances, to flutter with greater effort, and to drop down at last into the mouth of its fierce pursuer. But not the aquatic race alone, all animated nature seems combined against this little fish, which seems to be possessed of double powers, only to be subject to greater dangers. For though it should escape from its enemies of the deep, yet the tropic bird and the albatross, the boody and the man of war, are for ever upon the wing to seize it. Thus pursued in either element, it sometimes seeks refuge from a new enemy ; and it is not unfrequent for whole shoals of them to fall on ship board, where they furnish man with an object of useful curiosity. But it is suspected from this last circumstance, that their vision in air is not very distinct, as they strike against whatever happens to be in their way.

The taste of this fish somewhat resembles mackerel:—they are described by the ancients, as Johnson observes, under the name of *hirundo*.

The *slender flying-fish* agrees with the former in having the sides of the belly ridged, but it may be distinguished from it at first sight by the slenderness of the body, and the great

great length of the ventral fins. This species has been generally confounded with the former, or overlooked. Probably the ventral fins may assist its flight. It is not known what ocean or sea it inhabits.

The *great flying-fish* agrees with the slender one in the great length of its ventral fins, but differs in having a thick body. This fish is nearly two feet long; the common flying-fish not more than eight, nor the slender sort more than six inches.

Flying-fish are met with in vast shoals between the tropics, but are not confined to them; they have been seen, though rarely, and few in number, as low as the latitude of 40 deg. on the coast of North America, and 53 deg. of Europe.

The *trigla volitans*, or *kite-fish*, as described by Walcot, is here subjoined, from its apparent, or transitory resemblance to those already mentioned.

The head is square; two strong spines at the hinder gill cover ending in a long strong spine; body roundish and slender; on the scales run lengthwise, a scalloped thin ridge; between the dorsal fins a single short spine; ventral fins very large, reaching to the tail; four appendages under the throat, united by

a web; tail forked; length one foot and a half. When fresh taken, the back is either a light or dusty red; the belly white; and the ventral fins prettily spotted.

The *kite-fish* inhabits the Atlantic and Indian oceans, and the Mediterranean sea; when pursued by the dorado, &c. quits the water, and by means of its ventral fins flies in the air about a stone's cast.

It is common in the fish markets of Italy, Sicily, and Malta.

THE ECHENEIS, OR SUCKING FISH*.

THE accounts which the ancients have transmitted to us of this fish are much too marvellous to deserve notice, nor is the consistency of modern writers on the peculiarity of this animal, more to be relied on. The best description is that of Catesby, which with some additions by Walcot, we shall chiefly follow.

The *Echeneis Remora* is usually about a foot, (Walcot says two feet) in length; the head large, equal in bigness to the body, which grows smaller gradually to the tail, which is small. It has six fins, two growing from behind the gills, two more under the throat, a long one on the back, and opposite to it under the belly, another of the same form and size; the tail is forked.

What

* Commerson relates, that when a Sucking-fish is put into a vessel filled with sea water, frequently renewed, it may be kept alive for several hours, and that in this state, without any foreign body to which it can adhere, it remains upon its back and swims in that extraordinary position.

What this fish has peculiar to itself is, that the crown of the head is flat, and of an oval form, with a ridge, or rising, running lengthways, and crossways to this, sixteen ridges, with hollow furrows between, by which structure it can fix itself to any animal or other substance, as they are often found adhering to the sides of ships, and the bodies of sharks and other large fish. But the notion that this small fish was able to stop a ship under sail, or a whale in swimming, is entirely fabulous; all they can do is no more than what shells, or corals, and other foulnesses occasion, viz. to make her sail somewhat the slower. Catesby adds, that he has taken five of them from off the body of a shark, which were fixed on so fast to different parts of his body, that it required great strength to separate them. "I have also seen them, says he, disengaged and swimming very deliberately near the shark's mouth, without his attempting to swallow them, the reason of which I am not able to give."

The sucking-fish is esteemed tolerably good eating; though what Oppian and Pliny relate of its powers in stopping a galley with four hundred rowers, and a ship in full sail, merit no credit; yet like the marvellous accounts of
some

some other creatures, this appears to be not wholly without foundation. Abbé Fortis says, that once sailing in the Gulph of Venice in a small bark, the man at the helm suddenly called to his companion to kill a remora, which had fixed itself to the rudder, and which did then, as he had often experienced before, sensibly both retard, and alter the course of the vessel. Thus what might have happened to a boat, is by Oppian and Pliny transferred to a galley, or ship.

THE EEL—MURENA.

THIS is one of the soft-finned apodal fish; properly characterised under that head, and so generally known as to preclude further description.

The eel is possessed of a power of climbing over any obstacle; for by applying its glutinous and slimy body to the surface of the object it desires to surmount, it can thus creep up locks, weirs, and every thing that would prevent its ascending the current of the stream.

We

We have already noticed several fish that mount up rivers to deposit their spawn; there are others that descend the fresh water stream to bring forth their young in the sea:—Rhedi places the eel in this number.

About the month of August annually these creatures take the opportunity of the most obscure nights, and when the rivers are flooded by accidental rains to seek the ocean. When they have reached the sea, and produced their young, (for they are viviparous) they again ascend the stream, at different times, as opportunity offers, or as the season is favorable. Their passage usually begins about the end of January, and continues till towards the end of May, when they are taken in the river Arno, by millions, and so small, that an almost incredible number of them goes to a pound weight. In England it is certain that they descend the rivers after floods in great abundance, and are thus caught in nets.

Ammodytes, or *sand-eel*, belongs to the above genus. This fish resembles an eel, and seldom exceeds a foot in length. The head of the ammodytes is compressed, and narrower than the body; the upper jaw is narrower than the under, the body is cylindrical with scales,
hardly

hardly perceptible. There is but one species of the ammodytes, viz. the *tobianus*, or *launce*, a native of Europe. This fish gathers itself into a circle, and pierces the sand with its head in the centre. It is found in most of our sandy shores during some of the summer months; it conceals itself, on the recess of the tides, beneath the sand, in such places where the water is left, at the depth of about a foot; and is in some places dug out, in others drawn up by means of a hook contrived for that purpose. They are commonly used as baits for other fish, but they are also very delicate eating. They are found in the stomach of the porpoise; a proof that the last roots up the sand with its nose, as hogs do the ground.

THE PIKE.

THIS fish was but little known to the ancients, although it is a fresh-water fish and so common in every part of Europe. It is of

an oblong figure, with a large mouth, well furnished with teeth, and is likewise extremely voracious. It feeds on other fish, insects, water-rats, frogs, and aquatic birds, when it can catch them. It is likewise fond of eating the eggs of other fish, and will devour every thing in a fish-pond, if it be suffered to remain there for any length of time. But as the pike is reckoned a good dish, his days are greatly abridged; yet, in the opinion of many naturalists, it is the longest lived of all fish. The larger the pike, the coarser the food, and *vice versa*. This fish is peculiarly prolific, for we have counted in the body of a female pike about one hundred and fifty thousand eggs. These pikes frequently swallow other fish, as large as themselves; they seize them always by the head, and digest one part of their prey, before they can swallow or draw into their mouths the other. And what is particular in natural history, the pike having ravaged a pond, will attack and devour one another as before mentioned. The pike is remarkably long lived: in the year 1523 was caught in Suabia, a very large pike, who appeared very old, and, on examining it, they found a brass ring in one of his nostrils, on which was read

a Latin

a Latin inscription, the purport of which was, *The Emperor, Frederic II. has thrown me into this pond with his own hands, the 5th of October, 1262.* From hence they concluded, that this pike had inhabited that pond for above 260 years. The eggs of this fish are highly unwholesome and even dangerous, but their fat, liver, gall, and jaw-bones pulverised, are useful in physic.

The pike has been poetically styled the tyrant of the watery plain; and, in fact, in proportion to its strength and celerity, he is the most active and voracious of the fresh water fish. He will attack every fish less than himself, and is sometimes seen choaked by attempting to swallow such as are too large. It is immaterial of what species the animal it pursues appears to be, whether of another or its own; all are indiscriminately devoured; so that every fish owes its safety to its minuteness, its celerity, or its courage: nor does the pike confine itself to feed on fish and frogs; it will draw down the water-rats and the young ducks as they are swimming above.

Gesner relates a story of a mule that stooped to drink in the water, when a famished pike, that was near, seized it by the nose,

nor was it disengaged till the beast flung it on shore.

So great is the rapacity of the pike, that he will contend with the otter for his prey, and even endeavour to force it from him. For this reason it is dreaded by all other fish; and the small ones shew the same uneasiness and detestation at the presence of their tyrant, as the little birds do at the sight of a hawk or an owl. When the pike lies asleep near the surface, as is frequently the case, the lesser fish are often observed to swim round it in vast numbers, with a mixture of caution and terror.

THE MACKEREL—SCOMBER.

THIS is a salt-water fish without scales; its body is round and fleshy, terminating almost in a point at each extremity. It is ordinarily about a foot long; when in the water it appears yellow, and when out of it, a silver white, excepting some streaks or speckles of a deep blue on the back and sides.

Naturalists have observed, that the water wherein mackerel has been boiled, yields a light, after stirring it a little.

Some persons skilled in naval architecture, assert that the figure of the mackerel is the most commodious of all others for swimming, and have therefore proposed it as a model for the buildings of ships.

The mackerel is found in large shoals in divers parts of the ocean, but especially on the English and French coasts, during the months of April, May, and June.

Some

Some varieties of this fish are found among the Carribee islands.

THE GURNET—TRIGLA.

THIS also is a salt-water fish, about the size of a middling whiting; its tail, fins, and gills, and a great part of its body, are of a reddish cast; the head remarkably large in proportion to the body, which is round and very taper; and its fins of an unusual length, probably to remedy the inconvenience which, on account of the largeness of its head, it must otherwise labour under, in making its way through the water. In the western parts of the British coast, where it is most frequently caught, the meaner sort of people parboil, and afterwards steep it in pickle, calling it *sous'd gurnet*; a term that may serve to explain an expression somewhat contested in Shakspeare's Second Part of Henry IV. where Falstaff says,—“ If I be not ashamed of my soldiers, *I am a sous'd gurnet.*”

THE GREYLING, OR UMBER.

THE technical name of this fish is *Thymallus*. Its body is long and flat, the back is somewhat broad, and the belly rigid and thin. The back has two fins, and the tail is forked ; the head is small, the eyes large and protuberant ; the mouth is moderately large, and the upper jaw larger than the under ; it has no teeth, but the whole jaws are rough like a file.

Its back is of a dusky brownish green, with a somewhat bluish cast intermixed, and its sides of a more shining gloss, with an admixture of gold colour. The scales are almost of a rhomboidal figure, and the side lines are much nearer the back than the belly ; the sides are variegated with black spots placed irregularly, but there are none of these near the tail. The greyling seldom exceeds a pound, or at the utmost a pound and a half in weight.

This

This fish is caught in the fresh rivers in the mountainous counties of England, and in the like situations in Germany and other kingdoms; and is one of the finest tasted of all the fresh-water fish.—It feeds on worms, and spawns in May.

THE LOACH.

THE *Cobitis*, Loach, is a genus of fish of which there are five species. The eyes are in the upper part of the head; the gill-covering membrane has from four to five rays, and the body is nearly of an equal thickness throughout. The loach is found in several of our small rivers, keeping at the bottom on the gravel; and on that account it is in some places called the *groundling*. It is frequent in the stream near Amersbury in Wiltshire, where the sportsmen, through frolic, swallow it down alive in a glass of white wine.

THE SMELT—ATHEURIA.

THIS is a soft-finned abdominal fish ; the characters of which have been given : it includes two species.

1. The *hepsetus*, with about twelve rays in the fin next the anus. It is found in the Mediterranean, and is also very plentiful in the sea near Southampton; as well as on other coasts of our island. The length is about five inches, and the tail is much forked. It is a beautiful little fish, semi-pellucid, covered with scales; the colour silvery, tinged with yellow; beneath the side line is a row of small black spots. The highest season for this fish is from March to the latter end of May or beginning of June, in which month it spawns. It never deserts its accustomed places, and may be constantly taken except in hard frost.

2. The *menideus*, with twenty-four rays in the fin next the anus. This is a very small

VOL. IV. E e pellucid

pellucid fish with many black points interspersed; it has many teeth in the lips, but none in the tongue or jaws. It is found in the fresh waters of Carolina, and spawns in April.

OF above five hundred species of fish which the spinous class includes, we have attempted to pourtray the leading features of those which usually come under observation, and whatever could be collected of their general history has been faithfully detailed:—we must dismiss the subject therefore with a slight mention of a few which appear not interesting enough to deserve a particular description.

The *Perch* is hook-backed, not unlike a hog, armed with stiff bristles, and his sides with dry thick scales: he is voracious, and will venture on his own kind even with greater courage than the pike. It is distinguished by several transverse streaks, and by having the belly-fins red: it is from nine inches to a foot in length, and considerably thick in proportion. There are two species found among the Carribee islands and on the coasts of North America;

rica; one has the body striped lengthways with a light purplish red on a yellowish ground; the body of the other is striped transversely with yellow.

The *Mullet*, characterized among the prickly finned thoracii fish, No. 18; is common in the Mediterranean; and a kind of sausage, called *botargo* is made of its eggs and blood. The best kind comes from Tunis, in Barbary; it must be chosen dry and reddish. The people of Provence use a great deal of it, the common way of eating it being with olive oil and lemon juice. There is also a great consumption of it throughout the Levant.

The *Blenny* affords thirteen species, of which two deserve mention: the *viviparous*, which brings forth two or three hundred young ones at a time. Their season for parturition is a little after the depth of winter. Before Midsummer, they quit the bays and shores, and retire into the deep where they are commonly taken. They are a very coarse fish, and eaten only by the poorest people. They are common in the mouth of the river Eske, at Whitby, Yorkshire, where they are frequently taken from off the bridge, sometimes a foot in length.

The *Raninus*, with six divisions in the belly-fins, is found in the lakes of Sweden ; and it is remarkable that when this fish appears in the lake, all the other fish retire ; and what is worse, this is not fit for eating.

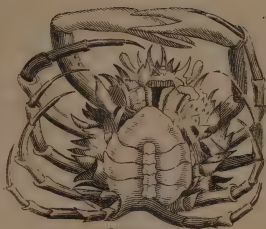
THE CRAB, THE LOBSTER, AND THEIR AFFINITIES.

THE language of philosophy, and that of mankind in general, is very different respecting the class of animals now coming under consideration : they are usually denominated *fish*, but many naturalists have placed them among the insect tribe ; while Goldsmith has placed them along with the turtle, though for what other reason than their crustaceous covering, it is not easy to discover.

From the first view of a lobster, it is obvious that its crustaceous covering bears a strong analogy to the bones of other animals ; and that by these shells the animal is sustained and



Lobster. FIG. 123.



Crab 124.



D. 125



Turtle 126.

and defended ; but in this respect they seem to invert the order of nature ; for as fish have their bones in the inside, and their muscles hung upon them for the purposes of life and motion—these crustaceous animals, on the contrary, have their bony parts on the outside, and all their muscles within ; their shell is not quite of a stony hardness, but rather resembles a firm crust, and in some measure capable of yielding. They seem to hold a middle rank between the former kind of animals we have been describing, and those snail-like creatures that properly receive the name of *testaceous fish*.

The generic characters of the crab are these ; they have eight legs (seldom ten or six) besides the two large claws which serve for the purpose of hands. They have two eyes at a considerable distance from each other, and for the most part supported by a kind of pedunculi, or footstalks ; the eyes are likewise elongated and moveable ; they have two clawed palpi, and the tail is jointed. Their genus includes the lobster, shrimp, &c. There are no less than eighty-seven species of cancer, distinguished principally by the length of their tails and the margins of their breasts. The following are the most remarkable.

The

The *Gammarus*, or common lobster, with a smooth thorax, short serrated snout, very long antennæ, and between them two shorter ones, bifid claws and fangs large, the greater tuberculated, the lesser serrated on the inner edge ; four pair of legs, six joints in the tail, tail-fins rounded. It inhabits all the rocky shores of our island, but chiefly where there is a depth of water. In Llyn, in Caernarvonshire, a certain small lobster, nothing different except in size, burrows in the sand. They are brought in vast quantities from the Orkney isles, and many parts of the Eastern coast of Scotland, to the London markets. Sixty or seventy thousand are annually brought from the neighbourhood of Montrose alone. The lobster was well known to the ancients, is accurately described by Aristotle, and is found as far as the Hellespont.

Lobsters fear thunder, and are apt to cast their claws on a great clap ; it is said that they will do the same on the firing of a great gun, and that when men of war meet a lobster boat, a jocular threat is used, that, if the master does not sell them good lobsters, they will salute him. The habitation of this species is in the clearest water, at the foot of
rocks

rocks that impend over the sea. This has given opportunity of examining more closely into the natural history of this animal, than of many others who live in an element that almost prohibits human researches, and limits the inquiries of the most inquisitive. Some lobsters are taken by hand ; but the greater quantity in pots, a sort of trap formed of twigs, and baited with garbage; they are formed like a wire mouse-trap, so that when the lobsters get in there is no returning. These are fastened to a cork sunk in the sea, and their place marked by a buoy. They begin to breed in the spring, and continue breeding most part of the summer. They propagate *more humano*, and are extremely prolific. Dr. Baster says he counted 12,444 eggs under the tail, besides those that remained in the body unprotruded. They deposit their eggs in the sand, where they are soon hatched. Lobsters change their crust annually. Previous to their putting off their old one, they appear sick, languid, and restless. They totally acquire a new coat in a few days ; but during the time that they remain defenceless they seek some lonely place for fear of being devoured by such of their brethren as are not in the same situation. It is also remarkable that lobsters and crabs will renew their claws if,

if, by accident, they are torn off; and it is certain they will grow again in a few weeks, though they never attain to the size of the first. They are voracious animals, and feed on seaweeds, garbage, and all sorts of dead bodies. The pincers of one of the lobster's large claws are furnished with knobs, and those of the other are always serrated. With the former it keeps firm hold of the stalks of submarine plants, and with the latter it cuts and minces its food very dexterously. The knobbed, or *numb* claw, as the fishermen call it, is sometimes on the right, and sometimes on the left side indifferently. It is more dangerous to be seized by them with the cutting claw than the other; but, in either case, the quickest way to get disengaged from the creature is to pull off its claw. The female, or *hen*-lobster does not cast her shell the same year that she deposits her *ova*, or, in the common phrase, is in *berry*. When the *ova* first appear under her tail, they are small, and extremely black; but they come in succession almost as large as ripe elder-berries before they are deposited, and turn of a dark brown colour, especially towards the end of the time of her depositing them. They continue full, and depositing the *ova* in constant succession, as long
as

as any of that black substance can be found in their body, which, when boiled, turns of a beautiful red colour, and is called their *coral*.

Hen-lobsters are found in berry at all times of the year, but chiefly in winter. It is a common mistake, that a berried hen is always in perfection for the table. When her berries appear large and brownish, she will always be found exhausted, watery, and poor. Though the ova be cast at all times of the year, they seem only to come to life during the warm summer months of July and August. Great numbers of them may then be found, similar in appearance to tad-poles, swimming about the little pools, left by the tides among the rocks, and many also under their proper form from half an inch to four inches in length. In casting their shells, it is hard to conceive how the lobster is able to draw the fish of their large claws out, leaving the shells entire, and attached to the shell of their body, in which state they are constantly found. The fishermen say that the lobster pines before casting, till the fish of its large claw is no thicker than the quill of a goose, which enables it to draw its parts through the joints and narrow passage near the trunk. The new shell is quite membranous at first, but

hardens by degrees. Lobsters only grow in size while their shells are in their soft state. They are chosen for the table, by their being heavy in proportion to their size ; and by the hardness of their shells on their sides, which, when in perfection, will not yield to moderate pressure. Barnacles and other small fish adhering to them, are reckoned certain signs of superior goodness. Cock-lobsters are in general better than the hens in winter ; they are distinguished by the narrowness of their nails, and by their having a strong spine upon the centre of each of the transverse processes beneath the tail, which support the four middle plates of their tails. The flesh of a lobster's claw is more tender, delicate, and easy of digestion, than that of the tail. In summer, the lobsters are found near the shore, and thence to about six fathom water ; in winter they are seldom taken in less than 12 or 15 fathoms. Like most insects, they are much more active and alert in warm weather than in cold. In the water they can rush nimbly upon their legs or small claws ; and, if alarmed, can spring, tail foremost, to a surprising distance, as swift as a bird can fly. The fishermen can see them pass about 30 feet ; and, by the swiftness of their motion, suppose they may go much

much further. Athenæus remarks this circumstance; and says, that “the incurvated lobsters will spring with the activity of dolphins.” Their eyes are raised upon moveable bases, which enable them to see readily every way. When frightened, they will spring from a considerable distance to their hole in the rock; and, what is not less surprising than true, will throw themselves into their hole in that manner through an entrance barely sufficient for their bodies to pass.

2. The strigosus, or plated lobster, with a pyramidal spiny snout; thorax elegantly plated, each plate marked near its junction with short striæ; claws much longer than the body, thick, echinated, and tuberculated; the upper fang trifid; only three legs spiny on their sides; tail broad. The largest of this species is about six inches long. It inhabits the coasts of Anglesea, under stones and fuci. It is very active: and, if taken, flaps its tail against the body with much violence and noise,

3. The astacus, or craw-fish, with a projecting snout, slightly serrated on the sides; a smooth thorax; back smooth, with two small spines on each side; claws large, beset with small tubercles; two first pair of legs clawed;

the two next subulated ; tail consisting of five joints ; the caudal fins rounded. It inhabits many of the rivers in England, lodges in holes which they form in the clay banks. Cardian says, that this species indicates the goodness of water : for in the best water they are boiled into the reddest colour.

The flesh of the cray-fish is cooling, moistening, and adapted to nourish such as labour under consumptions. Though they are variously dressed, yet no parts of them are eatable except their claws and tails. Soups are frequently made of them, which are rendered still more medicinal by the addition of herbs, snails, or other substances, according as circumstances may require. The flesh is accounted best in the summer months.

The delicate flavour of these fish depends in a great measure on their food. When they have well-tasted food, their flesh preserves the relish of it ; but when they feed on other things, they are often rendered of no value by the flavour which is thus communicated to their flesh.

There are great quantities of these fish in the river Odra, on the borders of Silesia ; but the people find them scarcely eatable, because of a bitter aromatic flavour, which is
very

very disagreeable in food. It has lately been observed, that the *calamus aromaticus* grows in vast abundance on the banks of that river, and that these creatures feed very greedily upon its roots. These have a very remarkable bitterness mixed with their aromatic flavour, while fresh, which goes off very much in the drying; and on comparing the taste of these roots with that of the cray-fish, there remains no doubt of the one being owing to the other.

They abound in the river Don, in Muscovy, where they are laid in heaps to putrify; after which the stones called *crabs-eyes* are picked out. These animals are very greedy of flesh, and flock in great numbers about carcases thrown into the water where they are, and never leave them while any remains. They also feed on dead frogs when they come in their way. In Switzerland there are some cray-fish which are red when they are alive, and others bluish. Some kinds of them also will never become red even by boiling, but continue blackish.

The cray-fish discharges itself of its stomach; and, as Geoffrey thinks, of its intestines too. These, as they putrify and dissolve, serve for food to the animal; during the time of the re-formation, the old stomach seems to
be

be the first food that the new one digests. It is only at this time that the stones are found called *crabs-eyes*; they begin to be formed when the old stomach is destroyed, and are afterwards wrapped up in the new one, where they decrease by degrees till they entirely disappear.

4. The serratus, a prawn, with a long serrated snout, bending upwards; three pair of very long filiform feelers; claws small, furnished with two fangs; smooth thorax; five joints to the tail, middle caudal fin subulated, two outmost flat and rounded. It is frequent in several shores among loose stones; sometimes found at sea, and taken on the surface over thirty fathoms depth of water; cinereous when fresh, of a fine red when boiled.

5. The crangon, or shrimp, with long slender feelers, and between them two projective laminæ; claws with a single hooked moveable fang; three pair of legs; seven joints in the tail; the middle caudal fin subulated, the four others round and fringed, a spine on the exterior side of each of the outmost. It inhabits the shores of Britain in vast quantities, and is the most delicious of the genus.

6. The squilla, with a snout like a prawn, but deeper and thinner; the feelers longer in proportion

proportion to the bulk; the sub-caudal fins rather larger; is, at full growth, not above half the bulk of the former. It inhabits the coast of Kent; and is sold in London under the name of the *white shrimp*, as it assumes that colour when boiled.

7. The atamos, or atam-lobster, with a slender body; filiform antennæ; three pair of legs near the head; behind which are two pair of oval vesiculæ; beyond are three pair of legs, and a slender tail between the last pair. It is very minute, and the help of the microscope is often necessary for its inspection.

8. The puler, or flea-lobster, with five pair of legs, and two claws imperfect, with twelve joints of the body. It is very common in fountains and rivulets; swims very swiftly in an incurvated posture on its back; embraces and protects its young between the legs; does not leap.

9. The locust, or locust-lobster, with four antennæ; two pair of imperfect claws; the first joint ovated; body consists of fourteen joints, in which it differs from the former. It abounds, in summer, on the shores beneath stones and algæ; leaps about with vast agility.

10. The

10. The *diogenes*, soldier-crab, or hermit-crab, with rough claws ; the left claw is the longest; (this being the only difference between the *diogenes* and *herpadus*) the legs are subulated, and serrated along the upper ridge; the tail naked and slender, and furnished with a hook, by which it secures itself in its lodging. This species is parasitic, and inhabits the empty cavities of turbunated shells, changing its habitation according to its increase of growth, from the small *nerite* to the large *whelk*. Nature denies it the strong covering behind, which it has given to others of this class ; and therefore directs it to take refuge in the deserted cases of other animals. They crawl very fast with the shell on their back ; and at the approach of danger draw themselves within the shell, and, thrusting out the larger claw, will pinch very hard whatever molests them. By the moderns it is called the *soldier*, from the idea of its dwelling in a tent ; or the *hermit*, from retiring into a cell.

It is very diverting to observe this animal when wanting to change its shell. The little soldier is seen busily parading the shore along that line of pebbles and shells which is formed by the extreme wave, still, however, dragging its old

old incommodious habitation at its tail, unwilling to part with one shell, even though a troublesome appendage, till it can find another more convenient. It is seen stopping at one shell, turning it, and passing it by; going on to another, contemplating that for a while, and then slipping its tail from its old habitation to try on the new; this also is found to be inconvenient, and it quickly returns to its old shell again. In this manner it frequently changes, till at last it finds one light, roomy, and commodious; to this it adheres, though the shell be sometimes so large as to hide the body of the animal, claws and all. Yet it is not till after many trials, and many combats also, that the soldier is thus completely equipped; for there is often a contest between two of them for some favourite shell for which they are rivals. They both endeavour to take possession, they strike with their claws, they bite each other, till the weakest is obliged to yield by giving up the object of dispute. It is then that the victor immediately takes possession, and parades in his new conquest three or four times backwards and forwards upon the strand before his envious antagonist. When this animal is taken it sends forth a feeble cry, endeavouring to seize the enemy with its nippers; which,

if it fastens upon, it will sooner die than quit the grasp.

The hermit crabs frequent mostly those parts of the sea-shore which are covered with shrubs and trees, producing various wild fruits on which they subsist; though they will also feed on the fragments of fish and other animal substances cast on shore. When roasted in the shell, they are esteemed delicate. The hermit crab, hung in the air, dissolves into a kind of oil, which gives speedy relief to rheumatic pains, if rubbed upon the part.

11. The *vocans*, or sand-crab, is but of a small size; its colour light brown, or dusky white. It has eight legs, and two claws, one of which is double the size of the other: these claws serve both to defend and feed themselves with. The head has two square holes, which are receptacles for its eyes, out of which it thrusts them and draws them in again at pleasure. Their only abode is on the sandy shores of Flathera, and many other of the Eahama islands. They run very fast, and retreat from danger into little holes which they make in the sand.

12. The *grapsus*, or red-mottled crab, has a round body, the legs longer and larger than in other kinds; the claws red, except which,
the

the whole is mottled in a beautiful manner with red and white. These crabs inhabit the rocks hanging over the sea; they are the nimblest of all others, and run with surprising agility along the upright side of a rock and even under the rocks that hang horizontally below the water. This they are often necessitated to do to escape the assaults of rapacious birds that pursue them. These crabs never go to land; but frequent mostly those parts of the promontories and islands of rocks in and near the sea, where by the continual and violent agitation of the waves against the rocks, they are always wet, continually receiving the spray of the sea, which often washes them into it; but they instantly return to the rock again, not being able to live under water, and yet requiring more of that element than any of the crustaceous kinds that are not fish.

13. The *granulatus*, or rough-shelled crab; these crabs are pretty large, and are commonly taken from the bottom of the sea in shallow water; the legs are small in proportion to the body; the two claws are remarkably large and flat. The whole shell is covered over with innumerable little tubercles like shagreen: the colour is brown, variously stained with purple.

G g 2

14. The

14. The *cancer erythropus*, or red-claw crab, is of a small size, and brown colour; it has two claws of unequal bigness, red at the ends, and eight legs, which seem of less use to them than in other crabs; for when on the ground, they crawl with a slow pace, dragging their bodies along; but they are mostly seen grasping with their claws, and hanging to some sea-plant, or other marine substance.

15. The *pisum*, or pea-crab, with rounded and smooth thorax, entire and blunt; with a tail of the size of the body, which commonly is the bulk of a pea. It inhabits the muscle, and has unjustly acquired the repute of being poisonous. The swelling after eating of muscles is wholly constitutional; for one that is affected by it, hundreds remain uninjured. Crabs either of this kind, or allied to them, the ancients believed to have been the consensaneous inmates of the PINNA, and other bivalves; which, being too stupid to perceive the approach of their prey, were warned of it by their vigilant friend.

16. The *manus*, or common crab, with three notches on the front; five serrated teeth on each side; claws elevated; next joint toothed; hind feet subulated; dirty green colour;

lour; red when boiled. It inhabits all our shores; and lurks under the algæ, or burrows under the sand. It is sold, and eaten by the poor of our capitals.

17. The *pagurus*, or black-clawed crab, with a crenated thorax; smooth body; hind feet subulated. It inhabits the rocky coasts; it is the most delicious meat of any; casts its shell between Christmas and Easter. The tips of the claws of this species are used in medicine for absorbing acidities in the stomach and bowels.

18. The *velutinus*, or velvet crab, with the thorax quinquedentated; body covered with short, brown, velvet-like pile; claws covered with minute tubercles; small spines round the top of the second joint; hind legs broadly ovated. This is among the species taken notice of by Aristotle on account of the broad feet, which, he says, assist them in swimming, as web-feet do the water-fowl. It inhabits the western coast of Anglesea.

19. The *horridus*, or horrid crab, with a projecting bifurcated snout, the end diverging; body heart-shaped, with the claws and legs covered with long and very sharp spines. It is a
large

large species, and inhabits the rocks on the eastern coasts of Scotland.

20. The *muricula*, land-crab, or violet-crab, with smooth entire thorax, and the two last joints of the feet armed with spines. It inhabits the Bahama islands, as well as most lands between the tropics; and feeds upon vegetables.

These animals live not only in a kind of orderly society in their retreats in the mountains, but regularly once a year march down to the sea-side in a body of some millions at a time. As they multiply in great numbers, they choose the month of April or May to begin their expedition; and then sally out by thousands from the stumps of hollow trees, the clefts of rocks, and the holes which they dig for themselves under the surface of the earth. At that time the whole ground is covered with this band of adventurers; there is no setting down one's foot without treading on them. The sea is their place of destination, and to that they direct their march with right-lined precision. No geometrician could send them to their destined station by a shorter course; they neither turn to the right nor left, whatever obstacles intervene; and even if they meet with a house, they will attempt to scale the walls to keep the unbroken

broken tenor of their way. But though this be the general order of their route, they, upon other occasions, are obliged to conform to the face of the country; and, if it is intersected with rivers, they are then seen to wind along the course of the stream. The procession sets forward from the mountains with the regularity of an army under the guidance of an experienced commander. They are commonly divided into three battalions; of which the first consists of the strongest and boldest males, that, like pioneers, march forward to clear the route, and face the greatest dangers. These are often obliged to halt for want of rain, and go into the most convenient encampment till the weather changes. The main body of the army is composed of females, which never leave the mountains till the rain is set in for some time; and then descend in regular battalia, being formed into columns of 50 paces broad, and three miles deep, and so close that they almost cover the ground. Three or four days after this the rear-guard follows, a straggling undisciplined tribe, consisting of males and females; but neither so robust nor so vigorous as the former. The night is their chief time of proceeding; but if it rain by day, they do not fail to profit
by

by the occasion; and they continue to move forward in their slow uniform manner. When the sun shines and it is hot upon the surface of the ground, they then make a universal halt, and wait till the cool of the evening. When they are terrified, they march back in a strange disorderly manner, holding up their nippers, with which they sometimes tear off a piece of the skin, and then leave the weapon where they inflicted the wound. They even try to intimidate their enemies; for they often clutter their nippers together, as it were to threaten those that come to disturb them. But though they thus strive to be formidable to man, they are much more so to each other; for they are possessed of one most unsocial property, which is, that if any of them by accident is maimed in such a manner as to be incapable of proceeding, the rest fall upon and devour it on the spot, and then pursue their journey.

When, after a fatiguing march, and escaping a thousand dangers, (for they are sometimes three months in getting to the shore), they have arrived at their destined port, they prepare to cast their spawn. The peas are as yet within their bodies, and not excluded, as is usual in animals of this kind, under the tail; for the
creature

creature waits for the benefit of sea-water, to help the delivery. For this purpose the crab has no sooner reached the shore, than it eagerly goes to the edge of the water, and lets the waves wash over its body two or three times. This seems only a preparation for bringing their spawn to maturity; for, without further delay, they withdraw to seek a lodging on land; in the mean time, the spawn grows large, is excluded out of the body, and sticks to the barbs under the flap, or more properly the tail. This bunch is seen as big as an hen's egg, and exactly resembling the roes of herrings. In this state of pregnancy, they once more seek the shore for the last time; and shaking off their spawn into the water, leave accident to bring it to maturity. At this time whole shoals of hungry fish are near the shore in expectation of their annual supply; the sea to a great distance seems black with them; and about two thirds of the crabs' eggs are immediately devoured by these rapacious invaders. The eggs that escape are hatched under the sand; and, soon after, millions at a time of these little crabs are seen quitting the shore, and slowly travelling up to the mountains. The old ones, however, are not so active in returning; they have become

so feeble and lean, that they can hardly creep along, and the flesh at that time changes its colour. The most of them, therefore, are obliged to continue in the flat parts of the country, till they recover, making holes in the earth, which they cover at the mouth with leaves and dirt, so that no air may enter. There they throw off their old shells, which they leave, as it were, quite whole; the place where they opened on the belly being unseen. At this time they are quite naked, and almost without motion for six days together, when they become so fat as to be delicious food. They have then under their stomachs four large white stones which gradually decrease in proportion as the shell hardens; and, when they come to perfection, are not to be found. It is at that time that the animal is seen slowly making its way back; and all this is most commonly performed in the space of six weeks.

This animal, when possessed of its retreats in the mountains, is impregnable: for, subsisting solely upon vegetables, it seldom ventures out; and its habitation being in the most inaccessible places, it remains for a great part of the season in perfect security. It is only when impelled by the desire of bringing forth
its

its young, and when compelled to descend into the flat country, that it is taken. At that time the natives wait for its descent in eager expectation, and destroy thousands, but, disregarding their bodies, they seek only for that small spawn that lies on each side of the stomach within the shell, of about the thickness of a man's thumb. They are much more valuable upon their return after they have cast their shell, for, being covered with a skin resembling soft parchment, almost every part except the stomach may be eaten. They are taken in the holes by feeling for them with an instrument; they are sought after by night, when on their journey, with flambeaux. The instant the animal perceives itself attacked, it throws itself on its back, and with its claws pinches most terribly whatever it happens to fasten on. But the dextrous crab-catcher takes them by the hinder legs in such a manner that the nippers cannot touch him, and thus he throws them into his bag. Sometimes also they are caught when they take refuge in the bottoms of holes in rocks by the sea-side, by clapping a stick at the mouth of the hole, which prevents their getting out; and then, soon after, the time coming, enters the hole, and the animal

is found upon its retiring, drowned in its retreat.

These crabs are of various sizes, the largest about six inches wide; they walk side-ways like the sea-crab, and are shaped like them; some are black, some yellow, some red, and others variegated with red, white, and yellow mixed. Some of them are poisonous; and several people have died of eating them, particularly the black kind. The light coloured are reckoned best; and when full in flesh, are very well tasted. In some of the sugar islands they are eaten without danger; and no small help to the negroe slaves, who, on many of these islands, would fare very bad without them.

From the foregoing description of many of the various species of crustaceous fish, it appears, that however different in figure the lobster and the crab may seem, their manners and conformation are nearly the same. Though without any red blood circulating through their veins, or any warmth in their bodies, they possess all the voracity of the finny tribe; yet they are condemned to lead an insect life at the bottom of the water; and though pressed by continual hunger, they are often obliged to wait till accident brings them
their

their prey. But whatever they seize upon, that has life, is sure to perish, though never so well defended: they even devour each other, and in some measure may be said to feed upon themselves, as the old stomach which they cast upon changing their shell is generally the first morsel that serves to glut the new.

When the offspring of these creatures first leave their parents they immediately seek for refuge in the smallest clefts of rocks, and crevices, &c. at the bottom of the sea, where the entrance is but small, and the opening can be easily defended. There, without seeming to take any food, they grow larger in a few weeks time, from the mere accidental substances which the water washes to their retreats. By this time also they acquire a hard, firm, shell, which furnishes them with both offensive and defensive armour. They then begin to issue from their fortresses, and boldly creep along the bottom in hopes of meeting with more diminutive plunder. The spawn of fish, the smaller animals of their own species, but chiefly the worms that keep at the bottom of the sea, supply them with plenty. They keep in this manner close among the rocks, busily employed in scratch-
ing

ing up the sand for worms, or surprising such heedless animals as fall within their reach, and leading a life of security, except from each other; for like other fish, the largest are the most formidable of all enemies to the small.

The operation of changing the shell is not only very painful, but also very dangerous, for many of them die under it. For some days previously to the change the animal becomes torpid and motionless; just before casting its shell it throws itself upon its back, strikes its claws against each other, and every limb seems to tremble; its feelers are agitated, and the whole body in violent motion; it then swells to a great degree; the shell opens, first at the junctures of the belly; and by a similar operation it is discharged of its claws, and in a short time the creature is at liberty, but so weak that it continues for some time motionless, possessing the softness and timidity of a worm, and hundreds of them fall a prey to the dog-fish, the cod, and the ray.

This state of imbecility remains for a short time, and when the lobster is completely equipped in its new shell, it will appear to have increased above a third in its size; and we are astonished how the deserted shell could have contained so large
an

an animal as that which entirely fills up the new.

To account for the speedy growth of the shell, it is supposed that the lobster possesses in itself a fluid of a petrifying quality ;—but this is, in fact, only explaining one mystery by another.

After what has been described, let us, in the words of Goldsmith, “ pause a little to reflect on the wonders this extraordinary creature offers to our imagination! an animal without bones on the inside, yet furnished with a stomach capable of digesting the hardest substances, the shells of muscles, of oysters, and even its own; an animal gaining a new stomach and a new shell at stated intervals; furnished with the instruments of generation double in both sexes, and yet with an apparent incapacity of uniting! Without red blood circulating through the body, and yet apparently vigorous and active! But most strange of all, an animal endowed with a vital principle that furnishes such limbs as have been cut away, and keeps continually combating, though in constant repair, to renew its engagements! Yet these are but a small part of the wonders of the deep, where Nature sports without a spectator.”

AMPHIBIOUS ANIMALS.

LINNÆUS has given the name of Amphibia to his third class of animals, including all those which partly live on land and partly in water.

It has been a question whether the animals commonly called *amphibious* live most in the water or on the land: the literal meaning of the word would imply, that animals having this title should be capable of living as well by land, or in the air, as by water; or of dwelling in either constantly at will; but it will be difficult to find any animal that can fulfil this definition as being equally qualified for either. Dr. Parsons, in a paper read before the Royal Society, divides them into two orders, viz. 1. Such as enjoy their chief functions by land, but occasionally go into the water. 2. Such as chiefly inhabit the water, but occasionally go ashore.

Of

Of the first order, he particularly considers the *phocæ*:—but respecting this we have already treated at large in a preceding volume.

Otters, beavers, and some kind of rats, go occasionally into the water for their prey, but cannot remain very long under water.

Frogs, however capable of remaining in the water, yet cannot avoid living on land, for they respire; and if a frog be thrown into a river, he makes to the shore as fast as he can.

The lizard-kind, such as may be called the water-lizard, are all obliged to come to land, in order to lay their eggs, to rest, and to sleep. Even the crocodiles, who dwell much in rivers, sleep and lay their eggs on shore; and, while in the water, are compelled to rise to the surface to breathe; yet, from the texture of their scaly covering, they are capable of remaining in the water longer by far than any species of the *phocæ*, whose skin is analogous to that of a horse or cow.

The *testudo*, or sea-tortoise, though he goes out to sea, and is often found far from land, yet being a respiring animal, cannot remain long under water. He has indeed a power of rendering himself specifically heavier or lighter than the water, and therefore can let himself

down to avoid an enemy, or a storm; yet he is under the necessity of rising frequently to breathe; and his most usual situation while at sea, is upon the surface of the water, feeding upon the various substances that float in great abundance every where about him; he can remain longer at sea than any other of this class, the crocodile excepted, because like the latter, his covering is not in danger of being too much macerated; yet they must go on shore to copulate and lay their eggs.

The animals of which we are now speaking, have also been divided into such as have lungs, and such as want them. The first species differ so considerably from an ox, or any other quadruped, that a few observations may be sufficient to give an idea of their internal structure; for this purpose, we shall first examine that species of them which most resembles man in the internal structure.

The *tortoise*.—The covering of this animal is composed of a shell so remarkably hard and firm in its texture, that a loaded waggon may go over it without hurting the shell, or the animal within it. In the young animal this shell grows harder in proportion as its
contents

contents expand; and it never changes its shell as some others do; hence it was necessary for it to be made up of different pieces and these are more or less distinct in several animals. Their feet are small and weak; and they are exceedingly slow in motion.

It has neither tongue nor teeth; but in lieu of them, their lips are so hard as to be able to break almost the hardest bodies.

The alimentary canal very much resembles that of the former class.

The principal difference is in the circulation of the blood. The heart has two distinct auricles, without any communication; and under these, there is the appearance of two ventricles, similar in shape to those of the former class; but they may be considered as one cavity; for the ventricle sends out not only the pulmonary artery, but likewise the aorta; there is a passage in the septum, by which the ventricles communicate freely, and the blood passes from the left into the right one. From the aorta the blood returns into the right auricle, while that, from the pulmonary artery returns to the left auricle, from which it is sent to the left ventricle, &c. so that only a part of the blood

is sent to the lungs, the rest going immediately into the aorta; hence the animal is not under the necessity of breathing so often as otherwise it would be.

From the base of the right ventricle goes out the pulmonary artery and aorta. The pulmonary artery is spent upon the lungs. The aorta may be said to be three in number; for the aorta sinistra ascends through the pericardium in company with the pulmonary artery; and afterwards turns down, and sends off a considerable branch, which splits into two; one of which joins the right aorta, while the other is distributed upon the liver, stomach, intestines, &c. What remains of this aorta, runs to the kidneys, or posterior extremities of that side. An aorta descendens, &c. after piercing the pericardium, runs down and communicates with the branch already mentioned, is distributed upon the right kidney, and inferior extremity, and also upon the bladder, or parts of generation. An aorta ascendens, after getting out of the pericardium, supplies the fore-legs, neck, and head. The blood in the superior part of the body returns to the right auricle by two jugular veins, which unite after perforating the pericardium. From the inferior

rior part it returns to the same auricle by two large veins ; one on the right side receives the blood in the right lobe of the liver ; the other on the left side, receives the blood in the left lobe, and also a trunk which corresponds with the inferior vena cava in other animals. The pulmonary vessels run in the left auricle in the common way.

The absorbent system in the turtle, like that in the former class, consists of lacteals and lymphatics, with their common trunks the thoracic ducts ; but differs from it in having no obvious lymphatic glands on any part of its body, nor plumes formed at the termination in the red vein.

The *lacteals* accompany the blood-vessels upon the mesentery, and form frequent networks across their vessels ; near the root of the mesentery, a place is formed which communicates with the lymphatics coming from the kidneys and parts near the anus. At the root of the mesentery on the left side of the spine, the lymphatics of the spleen join the *lacteals* ; and immediately above this a plexus is formed, which lies upon the right aorta. From this plexus a large branch arises, which passes behind the right aorta to the left side, and gets before the left aorta, where it assist
in

in forming a very large receptaculum, which lies upon that artery.

From this receptaculum arise the thoracic ducts. From its right side goes one trunk, which is joined by that large branch that came from the plexus to the left side of the right aorta, and then passes over the spine. This trunk is the thoracic duct of the right side; for having got to the right side of the spine, it runs upwards on the inside of the right aorta, towards the right subclavian vein; and when it has advanced a little above the lungs, it divides into branches, which near the same place are joined by a large branch, that comes up on the right side of the aorta. From this part upwards, those vessels divide and subdivide, and are afterwards joined by the lymphatics of the neck, which likewise form branches before they join them from below. So that between the thoracic duct and the lymphatics of the same side of the neck, a very intricate net-work is formed; from which a branch goes into the angle between the jugular vein, and the lower part or trunk of the subclavian. This branch lies therefore on the inside of the jugular vein, whilst another gets to the outside of it, and seems to terminate in it, a little above the angle, between that vein and the subclavian.

Into

Into the above-mentioned receptaculum the lymphatics of the stomach and duodenum likewise enter. Those of the duodenum run by the side of the pancreas, and probably receive its lymphatics and a part of those of the liver. The lymphatics of the stomach and duodenum have very numerous anastomoses, and form a beautiful net-work on the artery which they accompany. From this receptaculum likewise, (besides the trunk already mentioned, which goes to the right side) arise two other trunks pretty equal in size; one of which runs upon the left side, and the other upon the right side of the left aorta, till they come within two or three inches of the left subclavian vein; where they join behind the aorta, and form a number of branches which are afterwards joined by the lymphatics of the left side of the neck; so that here a plexus is formed as upon the right side. From this plexus a branch issues, which opens in the angle between the jugular and subclavian vein.

Serpent and Crocodile.—The circulation in these is similar to that of the turtle; but we find only one ventricle. The blood goes from the right auricle to the ventricle which sends out the pulmonary artery and aorta; the blood from the pulmonary artery returns to the
left

left auricle, that from the aorta going to the right auricle, and both the auricles opening into the ventricle.

Frog and Lizard.—These differ from the former animals, in having only one auricle and a ventricle; and besides, the ventricle sends out a single artery, which afterwards splits into two parts; one to supply the lungs, the other runs to all the rest of the body; from the lungs, and from the other parts, the blood returns into the auricle.

The above observations are sufficient to inform us of the nature of the first order of the class of amphibious animals; let us now see what is to be said of the second in our division of them, which are such as chiefly inhabit the waters, but occasionally go on shore.

These are but of two kinds; the eels, and water-serpents, or snakes of every kind. It is their form that qualifies them for locomotion on land, and they know their way back to the water at will; for by their structure they have a strong peristaltic motion, by which they can go forward at a pretty good rate; whereas all other kinds of fish, whether vertical or horizontal, are incapable of a voluntary locomotion on shore; and therefore, as soon as such fish

fish are brought out of the water, after having flounced a while, they lie motionless, and soon die.

Let us now examine into the reason why these vermicular fish, the eel and serpent kinds, can live a considerable time on land, and the vertical and horizontal kinds die almost immediately when taken out of the water. All land-animals have lungs, and can live no longer than while these are inflated by the ambient air, and alternately compressed for its expulsion; that is, while respiration is duly carried on, by a regular inspiration and expiration of air.

In like manner, the fish in general have, instead of lungs, gills or branchiæ: and as in land-animals the lungs have a large portion of the mass of blood circulated through them, which must be stopped if the air has not a free ingress and egress into and from them; so, in fish, there is a great number of blood-vessels that pass through the branchiæ, and a great portion of their blood circulates through them, which must in like manner be totally stopped, if the branchiæ are not perpetually wet with water. So that, as the air is to the lungs in land-animals a constant assistant to the circulation, so is the water to the branchiæ of those

of the rivers and seas ; for when these are out of the water, the branchiæ very soon grow crisp and dry, the blood-vessels are shrunk, and the blood is obstructed in its passage ; so, when the former are immersed in water, or otherwise prevented from having respiration, the circulation ceases, and the animal dies.

Again, as land-animals would be destroyed by too much maceration in water ; so fishes would, on the other hand, be ruined by too much exsiccation ; the latter being, from their general structure and constitution, made fit to bear, and live in the water ; the former, by their constitution and form, to breathe and dwell in the air.

But it may be asked, why eels and water-snakes are capable of living longer in the air than the other kinds of fish ? This is answered by considering the providential care of the great Creator for these and every one of his creatures : for since they were capable of locomotion by their form, which they need not be if they were never to go on shore, it seemed necessary that they should be rendered capable of living a considerable time on shore, otherwise their locomotion would be in vain.— How is this provided for ? Why, in a most convenient

convenient manner; for this order of fish have their branchiæ covered, while those of other kinds are much exposed to the air, and want the slimy water to keep them moist. Now, if any of these, when brought out of the water, were laid in a vessel without water, they might be preserved alive a considerable time, by only keeping the gills and surface of the skin constantly wet; even without any water to swim in.

It has been advanced, that *man* may, by art, be rendered amphibious, and able to live under water as well as frogs. As the fœtus lives *in utero* without air, and the circulation is there continued by means of the *foramen ovale*; by preserving the passage open, and the other parts in *statu quo*, after the birth, the same faculty would still continue. Now, the *foramen*, it is alleged, would be preserved in its open state, were people accustomed, from their infancy, to hold their breath a considerable time once a day, that the blood might be forced to resume its pristine passage, and prevent it drying up as it usually does.

This conjecture seems, in some measure, supported by the practice of divers, who are taught

from their childhood to hold their breath, and keep long under water, by which means the ancient channel is kept open. A Calabrian monk at Madrid laid claim to this amphibious capacity, making an offer to the king of Spain to continue twice twenty-four minutes under water, without ever coming up to take breath. Kircher gives an account of a Sicilian, named the *Fish-Colas*, who, by a long habitude from his youth, had so accustomed himself to live in water, that his nature seemed to be quite altered; so that he lived rather after the manner of a fish than that of a man.

THE TURTLE AND TORTOISE.

TESTUDO is the general name which comprehends all those animals known in English by the names of turtles and tortoises; and of which there are a great many species; some with four toes on each foot; others with five toes on the fore-feet, and four on the hinder ones; and others distinguished by other peculiarities, particularly the compartments of their shells, some being divided into irregular spaces, and others beautifully tessellated. The shells are much used in ornamental work.

The degree of strength and docility possessed by the tortoise, and the warm red blood circulating in its veins, certainly give it an apparent claim to a rank above fish;—on the other hand, it is of an amphibious nature; it is covered with a shell like a lobster, and it brings forth its young from the egg without hatching; these considerations

considerations tend to lessen its superiority, and degrade it among animals which in many respects it considerably surpasses.

A distinction has usually been made between the species that live upon land and those which subsist in the water; the former being called *tortoises*, the latter *turtles*. Seba, however, asserts that all tortoises are amphibious; that the land-tortoise will live in the water, and that the sea-turtle can be fed upon land. A land-tortoise was taken to him that had been caught in one of the canals of Amsterdam, which he kept for half a year in his house, where it lived very well contented in both elements. When in the water, he observed that it remained with its head above the surface; and when placed in the sun-beams, seemed delighted with the warmth, and remained immoveable during its continuance. Habit, therefore, rather than conformation, constitutes the difference between these animals, and they perhaps differ less than birds that live on the land and those that swim in the water.

The most remarkable distinctions between these animals shall now be pointed out: The first is in the size: the land-tortoise usually not exceeding three feet long by two feet broad;
but

but the turtle is sometimes from five to seven feet long. Not that the size can be relied upon as an unerring distinction; for in many parts of India the land-tortoises grow to a very great magnitude, though not big enough for a single shell to cover a house, as some of the ancients have gravely asserted.

The methods of living are certainly a more obvious distinction than the size of turtles. The land-tortoise lives in holes dug in the mountains or near marshy lakes; the sea-turtle in cavities of rocks and extensive pastures at the bottom of the sea; this chiefly uses its feet in swimming and creeping at the bottom; while the former employs its feet to walk with, and burrow in the ground.

The land-tortoise has a small head, somewhat resembling that of a serpent; an eye without the upper lid; the under eye-lid serving to cover, and keep that organ in safety. It has a strong scaly tail like the lizard; it can at pleasure put out or hide its head under the great penthouse of its shell, where, defended on every side, it remains secure from all attack. It lives chiefly on vegetable food, and never acts offensively; though any of the smaller animals who invade its repose, suffer smartly for their temerity; for the tortoise is possessed of such strength

strength of jaw, that though armed only with boney plates, instead of teeth, whenever it fastens it infallibly keeps its hold till it has taken out the piece.

The longevity, and the difficulty of destroying these animals are indeed extraordinary: so much so, that we are almost tempted to adopt Goldsmith's assertion, "*that nothing can kill them.*" When Rhedi was making some observations upon animal motion, he drew the brains from the head of a land-tortoise, by making a large opening in its skull, and washed the cavity so as not to leave the smallest part remaining: and then, leaving the hole open, set the animal at liberty—*"notwithstanding which the tortoise marched away, without seeming to have received the smallest injury:—only it shut the eyes, and never opened them afterwards."*

The hole in the skull, we are told, was seen to close, and in three or four days there was a complete skin covering the wound. In this manner the animal lived *without a brain* for six months, walking about unconcernedly, and moving its limbs as before.

The humanity of the Italian philosopher was not satisfied with this experiment, for he carried it

it a degree farther : “ he *cut off the head*, and
“ the animal lived twenty-three days after its
“ separation from the body. The head also
“ continued to rattle the jaws, like a pair of
“ castenets, for above a quarter of an hour.”

Such is the longevity of turtles, that they are commonly known to exceed eighty years of age ; and Goldsmith says there was one kept in the Archbishop of Canterbury’s garden at Lambeth, that had been remembered above a hundred and twenty. It was at last killed by the severity of a frost, from which it had not sufficiently defended itself in its winter retreat, which was a heap of sand at the bottom of the garden.

This principle of vitality seems not easily to be accounted for, as its food is the simplest possible, though in its choice not very delicate ; it indifferently feeds on leaves, fruit, corn, &c. and usually fills itself with whatever offers.

Like the bat, the serpent, the lizard, and some other animals, the tortoise retires to some cavern to sleep during the winter ; and at the time that food is no longer in plenty, the tortoise becomes insensible to its want ; but it is sufficiently attentive to make its retreat as comfortable as possible, by furnishing it with moss, grass, and other substances, as well for

VOL. IV. L 1 warmth

warmth as provision, should it prematurely awake from its repose, which seldom happens, however, until the genial return of spring, and when there is scarcely any diminution of its weight from its long confinement.

Soon after its return from torpidity, it prepares for the continuance of its species; but as all its actions are slow, and adapted to a creature of great longevity, so the genial embrace is said to be of proportional duration. The amount of the land tortoise's eggs are not ascertained, but from the scarcity of the animal they cannot be supposed to be very numerous.

Previously to the deposition of her eggs, the female tortoise scratches a slight hole in some warm situation, where the beams of the sun have their whole effect; there she leaves them, covered with grass and leaves, to be hatched by the heat of the season. In about twenty-six or thirty days the young tortoises are excluded, and no sooner quit the egg, than they seek after provision, the shell which covers them expanding with their growth.

The tortoise is supposed to destroy insects and snails in great abundance; it is therefore taken into gardens; and in hot countries they are domesticated, being great destroyers of bugs. Almost every family at the Cape
of

of Good Hope keeps a small land-tortoise, in the inclosed yard, behind the offices of the house, for the purpose of avoiding the pest of rats, which will not approach any place where the land-tortoise is harboured. One of these creatures was, some few years ago, very successfully kept, for the same purpose, in a small back garden of a house in Henrietta-Street, Covent-Garden. How they can be expert at such work as catching vermin, is not easy to be conceived ; but they appear in general harmless, and even fond of employment.

Walcot mentions the African tortoise, (*testudo Græca*) the shell of which is of a greenish yellow ; the scales on the back marked irregularly in the disk and edge, and the side ones obliquely with black ; down the belly are two broad black stripes ; tail short, no toes, five claws to the fore-feet, four to the hind. It inhabits Africa, feeds on vegetables, moves slowly, partly owing to the side bend of the legs ; at the approach of winter buries itself in the earth, where it passes that season in a torpid state. Its flesh is reckoned more palatable than the *turtles* of the Mediterranean.

The torpidity, or cessation from taking food, of the tortoises during a portion of the winter

L 1 2

months,

months; is among the most singular of their peculiarities: though in the animal creation we observe several other instances of long abstinence. It is the natural course for divers species to pass four, five, or six months every year without either eating or drinking: besides the tortoise, the bear, dormouse, serpent, swallow, fly, &c. are observed regularly to retire, at these seasons, to their respective cells, and hide themselves, some in the caverns of rocks, or ruins; others dig holes under ground; others get into the woods, and lay themselves up in the clefts of trees; and some are supposed to bury themselves under water.

In effect, several species of birds, almost the whole tribe of insects, and many among the other tribes, are able to subsist all winter, not only without food, but many of them without respiration. This furnishes an admirable instance of the wisdom of the Creator: the proper food of these creatures, especially of the insect tribe, being then wanting, there is a provision for them to live without it. When the fields are divested of their flowery furniture, and the trees and plants are stripped of their fruits, what would become of such animals as live upon the produce of spring and summer?

And

And when the air is grown rigid and chilly with frost, what would become of the many tender species who are impatient of cold? To prevent the total destruction and extirpation of many species of animals, the Author of Nature has provided that creatures thus bereaved of their food should likewise be impatient of cold, to lead them thus to shelter themselves out of the way of danger; and that when there arrived, the natural texture and viscosity of the blood should dispose it, by a further degree of cold, to lag and stagnate in the vessels; so that the circulation stopping, and the animal functions being in a great measure suspended, there is no sensible waste or consumption of parts, but they remain in a kind of drowsy neutral state, between life and death, until the warm sun revives both them and their food together, by thawing the congealed juices both of such animals and vegetables.

It is more than probable, that all motion of the animal juices is extinct in flies, and other insects, when thus asleep, because, even when cut in pieces, they do not awake, nor does any fluid ooze out of the wound, unless some extraordinary degree of warmth has been first applied to unbind the ice—The sleep of such animals

animals is little else than death, and their waking a resurrection—for if life does not consist in the circulation of the blood, in what it does still remains to be discovered. Hence it is no wonder that tortoises, dormice, bears, &c. are found as fat and fleshy after some months *abstinence* as before. Sir G. Ent weighed a tortoise several years successively at its going to earth in October, and on its coming out again in March; and found that, of four pounds four ounces, it only used to lose about one ounce. Philosophical Transactions, No. 194.

Indeed we have instances of men passing several months as strictly *abstinent* as other creatures. The records of the Tower mention a Scotchman imprisoned for felony, and strictly watched in that fortress for six weeks, in all which time he took not the least sustenance, and for which he had his pardon. The German *Ephemerides* speak of one Martha Taylor, who, by a blow on the back, fell into such a loss of appetite, that she took no sustenance, except a few drops with a feather, for thirteen months; but this was a morbid and unnatural case, for she slept but little all the time. We may add the instance of S. Chiltow, of Tinsbury, near Bath, who, in the year 1693, 1694, and 1695, slept sometimes

times four months, and sometimes above six together, with very little food ; and six weeks without any more than a little tent, conveyed with a quill into his mouth through a hole in his teeth. Philosophical Transactions, No. 304.

It is to be added, that in most instances of long *abstinence* related by naturalists, there were apparent marks of a texture of blood, and humours much like that of summer beasts and insects. It is no improbable opinion, however, that the air itself may furnish something for nutrition. It is certain that there are substances of all kinds, animal, vegetable, &c. floating in the atmosphere, which must be continually taken in by respiration. And that an animal body may be nourished thereby, is evident in the instance of vipers, which, if taken when first brought forth, and kept from every thing but air, will yet grow very considerably in a few days. So the eggs of lizards are observed to increase in bulk, after they are produced, though there be nothing to furnish the increment but air alone ; after the like manner, as the eggs or spawn of fish grow, and are nourished with the water. And hence, say some, it is that cooks, turnspit dogs, &c. though they eat but little, yet are usually fat.

The

The *turtle* is found much larger than the land-tortoise :—the sea, indeed, is possessed of the property of increasing the magnitude of animals which are congenial to that element. The great Mediterranean turtle is the largest of the kind known ; but its utility is by no means proportioned to its size ; it is so far unfit for food, that it is even said to be poisonous ; and the shell, which resembles a hide, is unfit for any useful purpose. One of these was caught in 1729, at the mouth of the Loire, nearly eight feet in length and two over, furnished with teeth in each jaw ; and a tail quite disengaged from the body, fifteen inches in length. Some others of this species have been since taken upon our coasts, that weighed from seven to eight hundred weight ; but an attempt to feast upon them has always been attended with disagreeable, or rather almost fatal consequences.

This is not the case with the different sorts which are imported for the gratification of luxury, and which are become the favourite food of those who are fond of eating much without the danger of surfeiting.

Four species of turtle have been mentioned as caught in the South Sea and Indian Ocean, viz.
the

the *trunk turtle*, the *loggerhead*, the *hawksbill*, and the *green turtle*.

Of the three first, the flesh is very indifferent eating; but the shell of the *hawksbill* serves for many valuable purposes. The substance of the other shells is thin and porous; that of the former is firm, and when polished is beautifully marbled, weighing from three to six pounds. The shell consists of thirteen plates, or leaves, of which eight are flat, and five hollow; and are separated by putting a fire under the shell when the flesh is taken out; and when scraped on both sides, they become beautifully transparent.

The *green turtle* (*Testudo Mydas*) has the fore fins of an oblong oval; those of the male are furnished with two claws; hind fins broad and round at the end, with one claw; shell convex, smooth, of a reddish brown, broke with a yellow, and rayed with a deep brown or black; sutures of the shell and edge of the side-scales waved; belly a pale yellow.

In the Philosophical Transactions for 1774, Article 32, we have an account of two new turtles, by Mr. Pennant:--one of them, which had never before been described, is found in fresh water, and is peculiar to the southern

rivers of America, particularly in Savannah and Altamaha rivers.

It is called the *soft-turtle shelled*, because the covering looks like leather, and for the most part is very smooth and pliable. It is very swift, and very fierce; its size is various, and it sometimes amounts to seventy pounds weight.

The colouring of the shell is a dark brown, with a slight tinge of green. The middle part is strong and boney, but round the sides and towards the tail it is cartilaginous, soft, and pliable, resembling thin tanned sole-leather. All the hinder part of the back is full of oblong smooth knobs, and the fore part is studded with knobs of a larger size.

The inside of it is very beautiful, of a bright whitish colour, interspersed with innumerable ramifications of blood-vessels. The under part of this shell, or coat, is white, and reaches two or three inches farther forward than the other, so that it affords rest and support for the head. The hinder part is hard and boney, and in shape resembles a saddle, with two pieces for the thighs to rest on. The fore-part is pliable and cartilaginous.

The head is somewhat triangularly shaped and lengthened, and the neck is easily extended

tended to a great length. The eyes are near to each other, and have large loose palpebræ. The pupil is surrounded by a lemon-coloured iris, perfectly round, and giving much fire to the eyes. When the animal sleeps, the loose part of the lower palpebræ is brought over the eye, like the *membrana nictitans* of birds.

The nostrils are the most singular; being, in an animal which weighed only twenty pounds, a cartilaginous production, of at least three-fourths of an inch beyond the upper and fore angle of the upper lip; perforated with two apertures, which reach back, and open into the roof of the mouth, having a smooth septum on each side.

The arms are thick and strong, consisting of three distinct joints, the upper, the fore arm, and the hand. The hands have each five fingers; the legs resemble the arms. The tail is large and thick; and the flesh a greater delicacy than even the green turtle.

The *tuberculated turtle*, Mr. Pennant supposes to be the *testudo coriana* of Linnæus; but he is not acquainted with its place and history. It is somewhat more than three inches long, and an inch and an half broad. The back is divided lengthways by five pro-

M m 2 minent

minent ribs, covered with large yellow tubercles. The whole circumference of the back is also bounded by a tuberculated rib, and the coat, or shell, is in all its parts pliable.

The belly is yellow, tuberculated like the back, and marked with six rows, greatly prominent, and has four fins, but neither toes nor nails on either of them.

Some of our ancient travellers have asserted, that the turtle was delicious, while others as strongly asserted that it was poisonous. this contradiction is easily solved by recurring to what we have said of the Mediterranean turtle; and it was by slow degrees only that the distinction came to be made between such as were malignant and such as were wholesome: a knowledge we chiefly owe to Dampier, who recommends the green turtle to be salted up for ship's provisions in case of necessity, though he hardly could foresee that this animal should make its way to the luxurious tables of Europe, and by that means gluttony be freed from one of its greatest restraints, the danger of a surfeit. And yet, to eat this creature in perfection, an epicure should take a voyage to the West-Indies; for, even after the best contrivances to import them in safety and vigour,

vigour, they are generally battered and lean on their arrival.

From the general appetite for devouring this animal, they are not only thinned in their numbers, but have become much more shy; and their bulk, if we can credit the testimony of ancient writers, is much less than formerly; a circumstance attributable to the same cause. Dampier speaks of one taken at Port Royal, in Jamaica, that was six feet broad across the back; and that a boy about ten years of age sailed in the shell as in a boat, from the shore to his father's ship, which was about a quarter of a mile from land. Yet Diodorus Siculus, Ælian, and Pliny, represent the turtles of their days as still larger—prodigiously so indeed!—for a certain people in Ethiopia, after eating the flesh made a tent of the shell. And in the island of Taprobane, (an island in the Indian sea) the houses were usually covered with a single shell. The greatest size spoken of by modern writers is on the Isle of Cuba, where they grow so large, that five men can stand upon the back of them together; yet this is a very uncertain way of estimating their dimensions.

This creature differs from those amphibious animals

animals which occasionally reside in the water, as it seldom quits the sea except to deposit its eggs, or to sport in fresh water. It is on their excursions to lay, when they are usually fat and healthy, that the turtles are commonly taken, and in the following manner, at least upon those uninhabited islands to which the green turtle chiefly resorts.

The men employed on this business land about night fall, and keep perfectly still when they see the turtle coming on shore. When she has proceeded to her greatest distance from the sea, and when she is most busily employed in scratching a hole in the sand, they sally out and surprise her. Father Labat, on whose authority we here speak, says, that their manner is to turn her upon her back, which utterly incapacitates her from moving; and yet, as the creature is very strong, and struggles very hard, two men find it no easy matter to lay her over. When thus secured, they go to the next, and, in this manner, in less than three hours, they have been known to turn forty or fifty turtles, each of which weighs from a hundred and fifty to two hundred pounds. The same writer assures us, that when the animal is in this helpless situation, it is heard to sigh very heavily, and is even seen to shed tears.

The

The chief food of the turtle is a submarine plant, that covers the bottom of several parts of the sea, not far from the shore; though they often seek their provisions among the rocks, feeding upon the moss and seaweed; and probably sometimes upon insects and other small animals. According to the relation of navigators, when the sea is calm, and the weather serene, the tortoises are seen feeding on the green carpet at the bottom of the sea, where the depth is but a few fathoms:—after they have fed sufficiently, they take their progress into the outlets of rivers for fresh water; there they take in a refreshing air, and then return to their former station. In the intermission of their feeding, they generally float with their heads above the surface of the water, unless they are alarmed by the motions of any hunters or birds of prey, in which case they suddenly plunge to the bottom.

Their time of coupling is from March till May; and their intercourse is of great duration: on this occasion they resort to low, flat, sandy coasts, as the sand seems a very convenient receptacle for their eggs; and in pursuit of a proper or favourite situation, they often take very considerable voyages.

Their

Their eggs are always deposited in cavities, in the sand, a little above the edge where the surges beat, and they cover them very lightly, that the sun may communicate to them a gentle warmth, and hatch their young. Whilst they are making preparation for their family, they furnish mankind and birds with a very plentiful provision; for they lay their eggs thrice, at the expiration of every fifteen days, and generally produce fourscore or ninety, or even more, at each fecundation.

When the creature has selected a spot for her nest, which is generally done about the close of evening, she returns without laying that night; but on the next, goes to deposit a part of her burthen; having scraped a round hole about one foot diameter, and a foot and a half deep, she leaves about eighty or ninety eggs, which are laid in about the space of an hour, each nearly as big as a hen's egg.

At the conclusion of about twenty-five days the young tortoises are seen to rise out of the sand, and, without any guide or instructions, march with a gentle pace to the water; but the waves unfortunately throw them back on the shore for the first few days, and then the birds dart upon them, and carry off the generality,

lity, before they have sufficient strength to make proper efforts against the surges, and dive to the bottom. So that out of three hundred eggs, it seldom happens that more than ten escape, and sometimes they are all destroyed.

It should seem, at the first view, that Nature, in this instance, charges herself with an unnecessary expense, or is even imperfect in her operations. But the falsehood and injustice of such an opinion is immediately evident. We never complain of the fertility of the hen, who frequently presents us with near a hundred eggs in a year, when not one chick is permitted to be hatched. We are very sensible that the intention of the Author of Nature, in this admirable fecundity, is to facilitate the preservation of the species, and, at the same time, to accommodate man and other animals with an excellent food : so that nothing in the works of Nature is either lost or defective ; and particular advantages are derived even from the slowness of a tortoise's motions ; for were she more expeditious, what a number of animals would be frustrated of their food ?

● Among the enemies which the young turtles have to fear, the parents themselves have been mentioned by some ancient writers, who

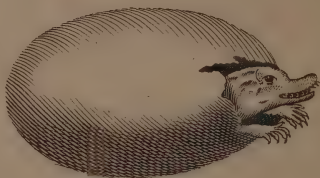
say that the mother waits for their arrival at the edge of the deep, and devours as many as she can. This circumstance is not well confirmed; though it is well known that the crocodile acts in this unnatural manner.

The calls of luxury have excited a variety of inventions to take these creatures; sometimes, when coupled together, by throwing a noose round their feet or neck: sometimes by striking them with a harpoon; and sometimes by diving underneath them, and seizing them by the tail when asleep on the surface of the water, having a boat ready to receive them.





Nautilus.



Crocodile's Egg.



Crocodile.

THE CROCODILE.

THIS animal has been usually placed among the lizard tribe; though we have here presumed to deviate from that arbitrary arrangement, and describe it with the amphibious creatures. The tail is two-edged, the feet triangular; the fore ones having five, and the hinder only four toes.

Within the mouth of this beast are two jaws of pointed teeth; its eyes are large, fiery, projecting out of the head, and secured within an osseous orbit, but immoveable, so that they can only see as they walk straight forward. The upper part of the snout and forehead consists of one fixed bone, reaching to the ears, which are broad, surrounded with a little border, and growing near the joint of the upper jaw, where also the largest scales begin. The upper part of the body is fenced with chomboidical scales, so closely joined together, that no separation is discernible, and a circular streak on each.

They are of a deep saffron yellow, mixed with a dark bay. All along the sides and back, to the end of the tail, are dented ranges of bosses. The scales on its thighs, legs, and toes, are beautifully variegated with a light yellow, and bright chesnut. Some crocodiles have five toes, both on their fore and hind feet; others have only four toes on their hind feet, but the fore feet have universally five toes, with pointed and crooked nails; so that in reality they are not so much like the foot of a beast as a man's hand with the four fingers and thumb extended; besides, in aquatic crocodiles, the toes of the hind feet are joined by a membrane like those of geese.

They chiefly haunt such large rivers as the Niger, Ganges, Nile, or near the sea-shore; never launching out far, either from fear of other monsters, or the convenience of laying their eggs in the sand to be hatched by the sun; these are from twenty to fifty in number, in size equal to a goose egg, but the shell is more brittle, and the contiguous tunicle both thicker and tougher.

When the little animal has thrust his head through these two, he is not able to get his fore feet and the rest of his body out of the shell, for the navel-string is connected with
the

the yolk of the egg, and closely wrapt about the foetus, being the conveyance of that nourishment whereby, at length, it gathers strength entirely to free itself from every obstruction. Thus the decrease of the yolk being the growth of the embryo, when it leaves the shell it carries along with it the remainder of the yolk, contained in a membrane fastened to the navel-string. Besides this string, there is another ligament, like the after-birth, the ends of which join to the inward tunicle, and to the belly of the foetus. Upon its being hatched, the navel-string and the after-birth detach themselves from the parts to which they are connected, and the infant crocodile is then enabled to begin his life of rapine.

The Leviathan of Scripture has been a subject of dispute among the learned; some fixing upon one animal, and some upon another. Dr. Shaw, who was doubtless well acquainted with eastern learning, is of opinion that the leviathan is no other than the crocodile, “ which, from the scaly quality and
“ hardness of its coat, (or, in the language of
“ Job, whose scales so stick together, that they
“ cannot be sundered) is in no danger of hav-
“ ing his skin filled with barbed irons, or his
“ head

“ head with fish spears. The crocodile is of
“ too great weight and magnitude, likewise,
“ to be drawn out of the river, as fish usually
“ are, with a hook. The crocodile then, from
“ these apposite characters, may well be taken
“ for the leviathan, as described in the book
“ of Job.” This conjecture is also adopted
in Calmet’s Dictionary.

But the crocodile is entirely a river animal, and never found in the sea ; and yet, in the 104th psalm, the leviathan is described to be an inhabitant of the great and wide sea, of the same ocean that is navigated by ships. If the Royal Psalmist’s description be strictly appropriate, then the leviathan cannot be the crocodile.

A distinction which, perhaps, does not exist in nature, is sometimes made between the crocodile and the alligator, the body of the former being said to be more slender than that of the latter ; its snout runs off tapering from the forehead, like that of a greyhound, while that of the other is indented, like the nose of a lap-dog. The crocodile has a much wider swallow, and is of an ash colour ; the alligator is black varied with white, and is thought not to be so mischievous ; but these distinctions are probably no more than minute variations.

Of

Of the history of all the ravenous or savage tribes of animal nature, the inhabitants of Europe are least interested in that of the crocodile ; for it is placed at a happy distance from cultivated society. Nor, indeed, is the crocodile at present that dreadful tyrant which formerly laid waste the banks of the Nile, and excited whole countries to repress its ravages. To view it in its natural terrors, and committing unceasing devastations, we must go to those immense rivers, that roll through the uninhabited regions of Africa and America ; where the arts and industry of mankind have not operated to the destruction or the enfeeblement of all the greater animals.

In the river of the Amazons, and in the Niger, these terrible destroyers still possess a residence, where they are found from eighteen to thirty feet long ; they frequently lie close to each other, and indolently bask on the surface ; so that a person not used to them might mistake them for trunks of trees, covered with a rough and dry bark ; the unhappy mistake would too soon be discovered, for the torpid animal, at the near approach of any living thing, darts upon it with instant
swiftness,

swiftness, and at once drags it down to the bottom.

In times of inundation the crocodile has been known to enter the cottages of the natives, where the dreadful visitant seizes the first animal it meets with. There have been examples of their taking a man out of a canoe, although there were several others in it, and with such dexterity as to prevent their giving him any assistance.

The crocodile's conformation denotes amazing strength in every part; the back-bone is closely jointed and firmly united; in both hind and fore-legs the muscles are very strong; its teeth are sharp and very numerous, and its whole form is calculated to shew the power it contains to exercise its natural weapons, which are irresistible; the principal of which is its tail; with a single blow of that it has been known to overturn a canoe, and by that means come with more ease at the conductor.

These animals very seldom leave the water, except to deposit their eggs, or when pressed with hunger. They in general float along upon the surface, and devour whatever kind of living creature comes within their reach, but when they experience a scarcity on that element

ment they approach the land, and lying quite under the banks, seize whatever animal comes to drink, by making a surprising spring, and, securing its hold both with teeth and claws, drag the victim under the water, and having thus drowned, devour it at ease.

There are various accounts given of the manner in which they are taken: in Siam, very strong nets are placed across the river at proper distances, where the creature, when caught, is suffered to exhaust its strength; the natives then approach him in boats, and wound him in several places, till he is perfectly weakened by loss of blood; his mouth is then tied up, his head is fastened to his tail, which is bent back like a bow, and he is otherwise secured, and when brought into subjection, is used to divert and entertain the great men of the East. It is managed, we are told by travellers like a horse, having a curb in its mouth, and being directed as the rider thinks proper.—But in other parts of the world, as well as at Siam, the crocodile is an object of savage pomp; for Philips, a voyager to the Guinea coast, informs us that there are two pools of water near the royal palace at Sabi, where crocodiles are bred, as we breed carps in our ponds in Europe.

What we have hitherto said is applicable to the crocodiles in unpeopled countries only, where they retain their fierce and savage nature, and where they shew a contempt for man until they have experienced his powers of destruction; but wherever the crocodile has been harrassed by mankind, its retreats invaded, and its numbers destroyed, it is there timorous and inoffensive;—nay, not merely inoffensive, for it is said even to be cherished and admired; and, in the opposite extreme, so gentle and harmless are the crocodiles in the river San Domingo, that the children play with them, ride upon their backs, and even beat them without receiving the smallest injury.

The generation of the crocodile is very similar in all respects to that of the turtle; except that at the period of vivification the female is instinctively taught that her young ones want relief, and she goes on land to set them free. But no sooner are they at liberty than they find their parent among the most unnatural of their enemies, and she devours as many of them as she is able.

But it is not the crocodile alone that thins their numbers; for to the negroes, a crocodile's egg is the most delicate morsel in the world; and

and they neither spare pains nor labour to obtain this favourite repast. A particular species of the vulture, as we have already mentioned, also exerts its power in abridging the fecundity of the crocodile, attentively watching the female at the time of her laying, and flocking in great numbers upon the hidden treasure; they tear up the eggs, and devour them in much shorter time than they were deposited.

Notwithstanding the extraordinary account given both by Linnæus and other distinguished naturalists, yet the fact of the crocodile's devouring her offspring is doubted by some. There is one species of this creature called the *open bellied crocodile*, which, like the opossum, is furnished with a false belly, into which the young creep when danger is apprehended; but probably this species is viviparous, and fosters her young, that are prematurely excluded, in this second womb until they arrive at maturity.

Of the time these animals exist, there are many opinions among the ancients, who were extremely partial to the invention of fables respecting them; but the most likely is that of Aristotle, who supposes the term of their lives to be about that of the human species.

TESTACEOUS FISH.

SYSTEMATIC distinctions, and specific divisions of things are useful in enlarging the comprehension of the mind: by methodizing the objects, they seem to extend the boundaries of knowledge; but having no real foundation in nature, they should not be depended on too far; for the aptitude which we have at combining very dissimilar objects in the same group, when hurried into the vortex of method, is evident from having placed the whale and the lippet, the tortoise and the oyster in the same order of animated beings, merely because they have one common abode.

Testaceous fish have been usually divided into three kinds. The *univalve*, or *turbinated*, the *bivalve*, and the *multivalve*.

The shell may be considered as a habitation of the animal furnished by nature: part of the stony substance of which the animal derives

derives from outward objects; and the fluids of the animal itself furnish the cement.

But to give a more exact idea of the manner in which sea-shells are formed, we must begin with the animal in its earliest state, and trace the progress of its shell from the time it first appears; for this purpose we select the shell of the garden snail. The animal does not leave the egg till its little habitation is sufficiently hardened. The beginning of the shell is not much larger than a pin's head, but grows in a very rapid manner, having at first but two circumvolutions, for the rest are added as the snail becomes larger. In proportion as the snail increases in size the circumvolutions of the shell increase also, until the number of the volutes come to be five, which it never exceeds.

To Swammerdam, the Dutch naturalist, whose industrious researches deserve the praise of every succeeding writer on the subject, we stand indebted for much of what we have to say on this head. The part, says he, where the animal enlarges its shell, is at the mouth, to which it adds in proportion as it finds itself stinted in its habitation below. Being about to enlarge its shell, it is seen with its little teeth biting and clearing away the scaly skin
that

that grows at the edges. It is sometimes seen to eat those bits it thus takes off; at other times it only clears away the margin when covered with films, and then adds another rim to its shell.

For the purpose of making the shell, without which the animal could hardly exist a few days, the whole body is furnished with glands, from which flows out a slimy liquor, which in time (though perhaps not without the aid of some extraneous matter) acquires a stony hardness. And that glistening substance which the snail leaves in its track on the floor or a wall, is no other than the materials with which the animal adds to its shell, or repairs it when broken.

The extraneous matter which goes to the composition of the shell, or at least to its external coat, which differs very evidently from the internal, is the accidental concretions of earthy or saline parts which adhere to the slimy matter on its first emission.

Under this idea we can more satisfactorily account for the various colours of the shell, which cannot be supposed to take its tincture from the animal's body; for all the internal parts of the shell are but of one white colour; whereas on their outsides we find them of almost every

every colour but blue; and that they never preserve any of the latter colour is easily to be accounted for, by the fact of sea-water, urine, or nitre, entirely drawing it from any substance. Thus then we may easily suppose the various colours are produced, not only by the juices which the animal furnishes, but from the mixture of sea or earthy particles which unites with them; for neither the animal slime, nor the external earthy or saline particles could produce colours of themselves, but being united, produce that variety which adorns the watery element; and it is not improbable that the nature of its food, as well as many external causes, may co-operate in contributing to its beauty.

But although the colouring of the shell is not to be entirely attributed to the animal itself, yet it certainly has the merit of giving it the general form, which solely depends upon the art, or rather instinct that Nature has bestowed upon each distinct species, and from whence it is that in the same kinds, the shapes are constantly invariable. If their bodies possess any tumour or excrescence, the incrustaceous covering is surely to have one that corresponds; when the animal makes any addition to its apartment, the same protuberance which had raised the shell in its early days, swells it again

at

at some little distance, by which means we see the same inequality in a spiral line all round the shell. In a word, if the body be channelled, the shell which covers it will be channelled, and if it has any protuberances, the shell will have them also in the exact size and shape.

Added to the beauty and diversity of shells, their numbers almost exceed belief, for besides those found in the sea, rivers, and with living animals upon land, they have been discovered in the bowels of the earth, forming banks of many fathoms in depth and breadth, and extending several miles in length: the latter of which, both from their multiplicity and greater variety, were long considered by the most eminent naturalists as the capricious productions of Nature, never having been the habitation of an animal, nor been in any other situation than that in which they were discovered. But that opinion has long since been exploded, and it is now generally admitted, wherever found, or in whatever quantities, they are the spoils of some animals who once received shelter therein, and are composed of one and the same substance; namely, that they are formed of an animal, or calcareous earth, which ferments with vinegar, and other acids, and that burns into lime, and
will

will not easily melt into glass:—this subject is most amply treated on in the first volume of the present work, page 219.

Many persons, struck with the variety and beauty of shells, have made the collection of them the principal pursuit of their lives. It is true that such pursuits are harmless and amusing, but little knowledge can be drawn from the most extensive cabinet of shells that ever was collected together; it is to those men who have contemplated something more than the outsides of these animals, that we must resort to for information on their nature and history. Rheamer paid great attention to their manners, and spent much time in examining and describing them with accuracy; but to the indefatigable industry of Swammerdam, mankind are much more indebted for knowledge on this subject. The patience and perseverance of this naturalist in the pursuit is almost beyond credibility: he had not only the difficulties attending the object, but also the prejudices of mankind to encounter, who were constantly ridiculing him for the undertaking. “It was in vain,” says a judicious modern, “that Swammerdam’s father “dissuaded him from what the world consi-

VOL. IV. P p “dered

“ dered as a barren pursuit; it was in vain that
“ an habitual disorder, brought on by his ap-
“ plication, interrupted his efforts; it was in
“ vain that mankind treated him with ridicule
“ while living, as they suffered his works to re-
“ main long neglected and unprinted when
“ dead: still the Dutch philosopher went on
“ peeping into unwholesome ditches, wading
“ through fens, dissecting spiders, and enume-
“ rating the blood-vessels of a snail; like the
“ bees, whose heart he could not only distin-
“ guish but dissect, he seemed instinctively
“ impelled by his ruling passion, although he
“ found nothing but ingratitude from man,
“ and though his industry was apparently be-
“ come fatal to himself.”

Indifference, however, to the talents of this great naturalist no longer exists; his merit shone through the gleam that ignorance cast round him, and his fame becomes more established, as his works become more consulted.

To his labours all succeeding naturalists have been indebted for the leading features in the history of animals that breed in shells; and though they have been able to relate more particulars, it was his genius that gave the clue to their discoveries; and therefore it is to him that we consider

consider ourselves the most indebted for the contents of this part of our work.

In searching into the history of the *turbinated shell-fish*, or those of the *snail-kind*, we are naturally led to bring forward at the head of them, the *garden-snail*, as one whose peculiarities it has been more easy to develope, than those which are perfectly of a similar form and nature, but whose residence is chiefly at the bottom of the deep. The snail, to the mere transient observer, appears to be little more than a lump of inactive matter, loaded with a crustaceous covering, and totally insensible to all the objects with which it is surrounded; but upon a more close inspection it will be found to be possessed of every faculty that can be possibly requisite for the life it is formed to lead; that its organs of life are furnished in as ample a manner as are to be found in any animal of the largest dimensions; that it has a tongue, brain, salival ducts, glands, nerves, stomach, and intestines; also liver, heart, and blood-vessels, with a purple bag that supplies a red matter to different parts of the body, together with strong muscles that hold it to the shell, and which are hardened like tendons at their insertion.

So far it may be said to possess qualities in common with other animals; but besides these

it has several peculiarities ; the most striking of which is the having its eyes placed on the points of the largest horns. When the snail is in motion four horns are plainly seen, the two topmost considerably bigger than the others, and at the extremities of those are the two eyes, which appear like bright black spots ; they are of a bulbous figure, have but one coat, and three humours, which are common in the eyes of other animals, namely, the vitreous, aqueous, and crystalline. The animal possesses the power of directing its eyes to any objects at will, and to preserve them from injury, can instantaneously contract them under the belly. Under the small horns is situated the mouth, and although the idea of teeth may appear inconsistent with an animal of such soft substance, it nevertheless possesses no less than eight, with which it is enabled to devour leaves and many other substances seemingly harder than itself ; nay, upon particular occasions, it will even bite off pieces of its own shell with them.

The next peculiarity in the snailkind is their being both male and female, and that while it impregnates another, it is capable of being impregnated itself. The vessels which supply the fluid for generation are principally placed on the fore-part of the neck, and extend themselves

selves over the whole body; but the male and female organs are almost united and grow close to each other. On the right side of the neck it has an opening which serves for very different purposes; in the first place it may be considered as the anus, it being the passage by which the excrements are excluded; next as a mouth, as through it the animal constantly respire; and lastly as an organ of generation, which regularly dilates when the desire of propagation begins; and within this opening every animal possesses those parts necessary for the continuance of their species.

When the time of coition approaches, they gather together, placing themselves quite close to each other; and taking little or no nutriment for several days. Having in this time settled their bodies in that position for the head and neck to be upright, they mutually impregnate each other; the coupling of these animals is generally thrice repeated, and that at the distance of fifteen days.

At the expiration of eighteen days, from the last coition, they produce their eggs, which also come out of the above opening in the neck; these they hide with great caution and industry under the earth. Their eggs are round, white, and covered with a soft shell; they

they produce them in very great numbers, and they are stuck together by a kind of slime, not in a thick bunch, but rather, as it has been said, like a bunch of grapes. On quitting the egg, the animal has a very small shell on its back, with only one convolution; this very soon enlarges, and the circles encrease with the growth of the animal; never however exceeding four rounds and a half in the garden snail, though there are sea snails which sometimes have no less than ten. The first circle remains in its original state, and the animal always adds to the shell at the mouth, which it encreases as it grows in size, and until it is sufficiently large to contain its whole body.

The snail is possessed not only of a power of retreating into its shell, but of mending it when broken. Sometimes these animals are crushed seemingly to pieces, and, to all appearance utterly destroyed; yet still they set themselves to work, and, in a few days, mend all their numerous breaches. The same substance by which the shell is originally made, goes to the re-establishment of the ruined habitation. The shell thus mended has a mottled appearance, all the new pieces being much whiter than the old fabric.

The

The snail is very voracious. It chiefly subsists upon the leaves of plants and trees; but is very delicate in its choice. At the approach of winter, it buries itself in the earth, or retires to some hole, to continue in a torpid state, during the severity of the season. It is sometimes seen alone; but more frequently in company in its retreat; several being usually found together, apparently deprived of life and sensation. For the purposes of continuing in greater warmth and security, the snail forms a cover or lid to the mouth of its shell with its slime, which stops it up entirely, and thus protects it from every external danger. When the cover is formed too thick, the snail then breaks a little hole in it, which corrects the effect of that closeness, which proceeded from too much caution. In this manner, sheltered in its hole from the weather, defended in its shell by a cover, it sleeps during the winter; and, for six or seven months continues without food or motion, until the genial call of spring breaks its slumber, and excites its activity.

The snail, having slept for so long a season, awakes one of the first fine days in April; breaks open its cell, and sallies forth to seek for nourishment; and, unlike most other torpid animals,

animals, comes out much thinner than when it commenced its fast. At first, it is not very difficult in the choice of its food; almost any vegetable that is green seems welcome; but the succulent plants in the garden are chiefly grateful; and the various kinds of pulse are, at some seasons, almost wholly destroyed by their numbers. A wet season is generally favourable to their production; for this animal cannot bear very dry seasons or dry places, as they cause too great a consumption of its slime, without plenty of which it cannot subsist in health and vigour.

Their method of proceeding from one place to another is by means of that broad muscular skin which commonly projects round the mouth of the shell; this they put out as far as they are able, and then, by a kind of contraction, draw the shell after; besides this they have a great advantage from the slime with which they are so copiously furnished; this they constantly emit whenever they move, and which not only smooths their way, but enables them also to ascend or descend trees in search of food, or wherever their inclinations direct them.

These are the most striking particulars in the history of this animal; and which may serve as
a general

a general picture to the manners and habits of the other tribes of this class. These are, the sea-snail, of which naturalists have, from the apparent difference of their shells, mentioned fifteen kinds; the fresh water snail, of which there are eight kinds; and the land-snail, of which there are five. All these bear a strong resemblance to the garden snail in the formation of their shell, in their hermaphrodite natures, in the slimy substance with which they are so amply supplied, and from which they derive so much assistance, in the peculiar opening in the neck, and in the mode of propagating their species.

But although possessed of these great resemblances, yet the *water-snails*, both *river* and *sea*, are found in some things to differ very materially. In the first place, all snails which live in water are furnished by Nature with a contrivance that enables them either to rise to the surface, or sink to the bottom of the water; this is performed by opening and shutting the orifice on the right side of the neck, which is supplied with muscles for that purpose. The snail sometimes gathers this aperture into an oblong tube, and stretches it above the surface of the water, in order to draw in, or expel the

VOL. IV. Q q water,

water, as it finds occasion. By dilating this it rises; by compressing it the animal sinks to the bottom. We may have a thorough conception of this process by referring to little glass images put in a tube of water, which are made to rise or sink by pressing the air contained at the mouth of the tube.

This striking difference between the freshwater and the garden snail, is not, however, general in those of the sea kind; among which there are some that are found viviparous, while others lay eggs in the usual manner. But this is not the only difference between land and sea snails. They are, it is true, all hermaphrodites; but still their nature of coition is by no means the same, for by the situation of the parts of generation the one cannot be impregnated by that which is empregnating, but a third is absolutely necessary, and Mr. Adanson says, he has seen a vast number of sea-snails fastened together, like a chain, impregnating each. Many of the latter also entirely want horns, and none of them have above two. Indeed, if the horns of snails be furnished with eyes, and if, as some are willing to think, the length of the horn, like the tube of a telescope, assist vision, these animals that chiefly reside in the gloomy bottom

tom of the deep, can have no great occasion for them. Eyes would be unnecessary to creatures whose food is usually concealed in the darkest places; and who, possessed of very little motion, are obliged to grope for what they subsist on. To such, eyes would rather be an obstruction than an advantage; and perhaps even snails that live upon land, are without them.

There is a difference also in the position of the mouth, in the garden and the water-snail. In the former, the mouth is placed cross wise, as in quadrupeds; furnished with jaw bones, lips, and teeth. In most of the sea-snails, the mouth is placed longitudinally in the head; and, in some, obliquely, or on one side. Others, of the *trochus* kind, have no mouth whatsoever; but are furnished with a trunk, very long in some kinds, but shorter in others.

But a more particular difference is the water-snails being viviparous; they not only bring forth their young alive, but with their shells upon their backs; which, strange as it may appear, is nevertheless the fact; and which we have incontestibly proved by an experiment of Swammerdam. He says, “ On the
“ twelfth of March I began my observations
“ on this snail, and collected a great number

“ of the kind, which I put into a large bason
“ filled with rain-water, and fed for a long
“ time with potter’s earth, dissolved in the
“ water about them. On the thirteenth of
“ the same month I opened one of these
“ snails, when I found nine living snails in
“ its womb ; the largest of these were placed
“ foremost, as the first candidates for ex-
“ clusion. I put them into fresh water,
“ and they lived to the eighteenth of the
“ same month, moving and swimming, like
“ snails *full grown* ; nay, their manner of
“ swimming was much more beautiful.”

The *trochus*, commonly considered of the snail species, has no mouth whatever, but simply a kind of trunk, which in proportion to the size of the animal is very long ; this trunk is fleshy, muscular, supple, and hollow ; its extremity is bordered with a cartilage, and toothed like a saw. These snails are a predatory species, and are justly considered among the shelly tribe, the same as the tiger, eagle, and shark are to beasts, birds, and fish. The whole race of shelled animals, with every possible means, endeavour to avoid their approach, conscious, as it were, that whatever may be their size, their destruction is inevitable, as the strongest covering

ing

ing is not proof against the power of this rapacious enemy. The shell of the trochus is very thick, and they are very clumsily formed, yet they proceed with greater swiftness than almost any other shell-fish, seize their prey with astonishing facility, and scarcely ever suffer the object they once have in pursuit to escape. The bulk of their intended victim does not appear to be of the smallest consequence, for they attack the largest with the same boldness as they do one of the most inferior size. Having once closed on the shell, however thick, they almost instantaneously penetrate it with their augre-like trunk. Thus fixed, all efforts to escape on the part of the other is entirely useless; if it expand, and comes to the surface, the trochus comes up also; and if it plunge to the bottom, the fell destroyer still maintains its hold. In this manner it will adhere, until with its trunk it has sucked all the substance of the other fish, even for days and weeks; nor ever quit its prey until it has so done, unless the other begin to putrefy.

That almost the whole tribe of shell-fish are subject to the attacks of the trochus is fully demonstrated by the fact, that there is scarcely

scarcely ever a shell met with that is entirely sound to the end of its convolutions. The thinnest shells are found to be the most penetrated, and this is readily to be accounted for: they being the most easily pierced, the predatory shell-fish, or the sea-worms, chiefly seek them out for subsistence; and thus it is that not one in a thousand of the thin paper-like shells, however small, is found that has not suffered some disaster. The only chance these have of escaping is in their lightness, sometimes enabling them to outsail their heavy pursuers; and this had led most naturalists to conclude, (together with the fact that the food of all snails properly lays at bottom) that “when the
“thin-shelled fish are seen busily swim-
“ming at the surface, instead of sporting
“or sunning themselves, as some have sup-
“posed, they are actually labouring to escape
“their most dreadful pursuers.”

The *nautilus*, of all the snail kind, has the thinnest shell, and is the most frequently seen swimming upon the surface; but whether it be at those times employed in seeking its food, or endeavouring to escape its numerous enemies, as above conjectured, we shall not presume positively to decide; it is sufficient

to

to observe, that the latter is the most probable, as upon opening the stomach, it is found to contain chiefly that food which it finds at the bottom.

This animal's industry may, therefore, be owing to its fears; and all those arts of sailing which it has taught mankind, may have arisen from the effects of its own necessity. Although there are several species of the nautilus, yet they may be divided into two: the one with a white shell, as thin as paper, which it is often seen to quit, and again to resume; the other with a thicker shell, sometimes of a beautiful mother-of-pearl colour, and which quits its shell but rarely. This shell outwardly resembles that of a large snail, but is generally six or eight inches across: within, it is divided into forty partitions that communicate with each other by a kind of doors, through which one could not thrust a goose-quill: almost the whole internal part of the shell is filled by the animal, the body of which, like its habitation, is divided into as many parts as there are chambers in its shell: all the parts of its body communicate with each other, through the doors or openings, by a long blood-vessel, which runs from the head to the tail; thus the body of the animal, if taken out of the shell, may be compared

pared to a number of soft bits of flesh, of which there are forty threaded upon a string. From this extraordinary conformation, one would not suppose that the nautilus sometimes quit-
ted its shell, and returned to it again; yet, nothing, however seemingly impossible, is more certain. The manner by which it contrives to disengage every part of its body from so intricate a habitation, by which it makes a substance, in appearance as thick as one's wrist, pass through forty doors, each of which would scarcely admit a goose-quill, is not yet discovered: but the fact is certain, for the animal is often found without its shell, and the shell more frequently destitute of the animal. It is most probable, that it has a power of making the substance of one section of its body remove up into that which is next; and thus, by multiplied removals, it gets free.

But this, though very strange, is not the peculiarity for which the nautilus has been the most distinguished. Its "spread-
" ing the thin oar," and " catching the
" flying gale," to use the poet's description of it, has chiefly excited human curiosity. These animals, particularly those of the white, light kind, are chiefly found in the Mediterranean; and there are scarcely any who have sailed

on

on that sea, but must have often seen them. When the sea is calm, they are observed floating on the surface; some spreading their little sail; some rowing with their feet, as if for life and death; and others still, floating upon their mouths, like a ship with the keel upwards. If taken while thus employed, and examined, the extraordinary mechanism of their limbs for sailing will appear more manifest. The nautilus is furnished with eight feet, which issue near the mouth, and may as properly be called barbs: these are connected to each other by a thin skin, like that between the toes of a duck, but much thinner, and more transparent. Of these eight feet thus connected, six are short, and these are held up as sails to catch the wind in sailing: the two others are longer, and are kept in the water, serving, like paddles, to steer their course by. When the weather is quite calm, and the animal is pursued from below, it is then seen expanding only a part of its sail, and rowing with the rest: whenever it is interrupted, or fears danger from above, it instantly furls the sail, catches in all its bars, turns its shell mouth downward, and instantly sinks to the bottom. Sometimes also it is seen pumping the water from its leaking hulk;

and when unfit for sailing, deserts its shell entirely. The forsaken hulk is seen floating along, till it dashes, by a kind of shipwreck, upon the rocks of the shore.

Such are the various manners in which the nautilus is constantly seen exercising itself in the Mediterranean sea ; and considering them in every point of view, we feel ourselves inclined to join in opinion with those naturalists who have concluded that the animal, by those efforts, is endeavouring to save itself from the rapacity of its pursuers, rather than seeking for food, or wantonly sporting on the surface of its natural element. And this conclusion they have drawn from the certain fact, that no animal of the sea has such a number of deadly enemies ; arising principally, as we before remarked, from the thinness of its shell, which is scarcely ever found in perfect preservation, but in general with some conspicuous marks of having been hostilely invaded. The trochus, crab, sea-scorpion, sea-worm, and a variety of other predatory creatures that lurk at the bottom of the deep, are its constant and invariable foes, and from whom it has no chance of escaping but by that comparative swiftness which it derives from its lightness, and those little arts above referred

referred to, which have often been contemplated with equal pleasure and astonishment.

The whole tribe of the snail kind have more to apprehend from their own species than is the case with that of any other animal, for, with scarcely an exception, they will attack and destroy each other, and that too in preference to seeking any different kind: the thin-shelled and weak, fall a prey to the more powerful, and those which are completely covered with a shell, even though closed at its mouth, find no security from the rapacity of the trochus.

We now come to the *bivalved shell-fish*, or those of the *oyster* kind; and which, in every respect are much inferior to those we have just described, whether considered as to their sensations, powers of motion, or in their system of generation. In the latter there is a most material difference, notwithstanding, that all the animals of this class, as well as those of the snail-kind, are hermaphrodite, but then the latter require the assistance of each other, for the propagating their species, whereas the bivalved tribe are completely endowed with powers for that task, each in its individual self, and totally independent of any other. Their other differences will be sufficiently ap-

parent as we proceed, and therefore need not be dwelt upon here.

The fresh-water *muscle* is generally placed foremost in this race, as possessing the common manners of the whole tribe, and being the one which, not only Swammerdam, but every other naturalist, found the most easy to procure, and consequently the most easy to become acquainted with.

The *muscle*, whether belonging to fresh or salt water, consists of two equal shells, joined at the back by a strong muscular ligament, that answers all the purposes of a hinge. By the elastic contraction of this, the animal can open its shells at pleasure, about a quarter of an inch from each other. The fish is fixed to either shell by four tendons, by means of which it shuts them close, and keeps its body firm from being crushed by any shock against the walls of its own habitation. It is furnished, like all other animals of this kind, with vital organs, though these are situated in a very extraordinary manner. It has a mouth furnished with two fleshy lips; its intestine begins at the bottom of the mouth, passes through the brain, and makes a number of circumvolutions through the liver; on leaving this organ, it goes on straight into
the

the heart which it penetrates, and ends in the anus, near which the lungs are placed, and through which it breathes, like those of the snail kind; and in this manner its languid circulation is carried on.

Each muscle has double organs of generation, namely, two ovaries to serve the purposes of the female, and two seminal vessels resembling what are commonly found in the male. Each ovary and each seminal vessel has its own proper canal; by the ovary canal the eggs descend to the anus; and there also the seminal canals which send their fluids to impregnate them. By this means Nature has contrived to make one animal supply the double purposes of generation, and that which forms the egg, is capable of impregnating it also. The ovaries usually empty themselves of their eggs in spring, and are replenished again in autumn; a matter that is pretty certain, since we generally find them empty in summer and full in winter. Their fecundity is astonishingly great, and wherever any of this tribe breed, they are sure to be found in almost innumerable quantities. And here again we meet with that circumstance which frequently occurs in animated nature; that is, the more defence-

less

less the animal, the more prolific it will be found in its species, and that its enemies and destroyers are always in proportion to the numerous multiplication of its progeny. In the present instance, there is not a predatory shellfish, but which is an avowed enemy to the bivalved race, and more particularly of the muscle; all the various species of crabs, crayfish, &c. pursue and devour them with avidity; but the trochus is their most formidable enemy: thousands of their shells are found entirely destitute of substance, and which has evidently been drawn out by the trochus, as in those cases a small hole is invariably to be perceived in some part of the shells.

But notwithstanding the number of this creature's animated enemies, it seems still more fearful of the agitations of the element in which it resides; for if dashed against rocks, or thrown far on the beach, it is destroyed without a power of redress. In order to guard against these, which are to this animal the most common and the most fatal accidents, although it has a power of slow motion, yet it endeavours to become stationary, and to attach itself to any fixed object it happens to be near. For this purpose it is furnished with a very singular capacity

capacity of binding itself by a number of threads to whatever object it approaches ; and these Rheumur supposes to be spun artificially, as spiders do their webs, which they fasten against a wall. Of this, however, later philosophers have found very great reason to doubt. It is, therefore, supposed that these threads, which are usually called the beard of the muscle, are the natural growth of the animal's body, and by no means produced at pleasure ; in which supposition they seem to have some warranty, from the great length to which many of those beards arrive, far exceeding that of the body itself ; and what is still more, they always encrease with the growth of the animal. But by whatever means the beard may be produced, nothing is more certain than the muscle makes use of it for the purpose of attaching itself to some object ; and if a quantity are thrown into a river where they cannot meet with any rocky substance, they will even twist their threads round each other, and large bunches of them are often taken in that situation.

Its instrument of motion, by which it contrives to reach the object it wants to bind itself to, is that muscular substance resembling a tongue, which is found long in proportion to the
the

the size of the muscle. In some it is two inches long, in others not a third part of those dimensions. This the animal has a power of thrusting out of its shell; and with this it is capable of making a slight furrow in the sand at the bottom. By means of this furrow it can erect itself upon the edge of its shell; and thus continuing to make the furrow in proportion as it goes forward, it reaches out its tongue, which answers for the purpose of an arm, and thus carries the shell edgeways, as in a grove, until it reach the point intended. There, where it determines to keep up its residence, it fixes the ends of its beard, which are glutinous, to the rock, or the object, whatever it be; and thus, like a ship at anchor, braves all the agitations of the water. Some of them contrive to fasten themselves by several of these threads; while others make use of only three or four, which appear scarcely able to retain it. Being once securely fixed, the muscle lives upon the little earthy particles which the water washes over its shells, and some authors suppose the little animalculæ the water contains. In this manner there have been instances of their growing to a foot in length. The beards have been seen a foot and a half long; and of this substance,

stance, the natives of Palermo sometimes make gloves and stockings.

These shell-fish are found in lakes, rivers, and in the sea. Those of the lake often grow to a very large size; but they seem a solitary animal, and are found generally separate from each other. Those of rivers are not so large, but yet in greater abundance; but the sea muscle is in most plenty. These are often bred artificially in salt-water marshes that are overflowed by the tide; the fishermen throwing them in at the proper seasons, and there being undisturbed by the agitations of the sea, and not preyed upon by their powerful enemies at the bottom, they cast their eggs, which soon become perfect animals, and these are generally found in clusters of several dozens together. It requires a year for the peopling a muscle-bed; so that, if the number consists of forty-thousand, a tenth part may annually be left for the peopling the bed anew. Muscles are taken from their beds from the month of July to October.

The *oyster* differs very little from the muscle, except in the thickness of its shell, and in its greater imbecility. The oyster, like the muscle, is formed with organs of life and res-

piration, with intestines which are very voluminous, a liver, lungs, and heart. Like the muscle, it is self-impregnated; and the shell, which the animal soon acquires, serves it for its future habitation. Like the muscle, it opens its shell to receive the influx of water, and, like that animal, is strongly attached to its shells both above and below.

Among the foremost of its differences, we may reckon that of the shape of the shells; those of the muscle being equally bulged alike, whereas the oyster has one nearly, if not entirely flat, the which is from necessity always kept upwards, as the other serves to hold the water requisite for its subsistence. The shells are also so thick and well lined, that, they appear perfectly well guarded against the attacks of the predatory tribe, and even the trochus will pass by them, in hopes of obtaining more easy prey. From their being perfectly stationary, a number of small reptiles cling to their shells, as the pipe and little red worms, and where they live in perfect security. The oyster is utterly unable to change its situation. It is entirely without that tongue which answers the purposes of an arm in the muscle; but nevertheless is often attached very firmly to any ob-

ject

ject it happens to approach, whether rocks, stones, pieces of timber, or sea-weeds; nay, nothing is so common in the rivers of the tropical climates as to see oysters growing even amidst the branches of the forest. Many trees which grow along the banks of the stream, often bend their branches into the water, and particularly the mangrove, which chiefly delights in a moist situation. To these the oysters hang in clusters, like apples upon the most fertile tree; and in proportion as the weight of the fish sinks the plant into the water, where it still continues growing, the number of oysters encrease, and hang upon the branches. This is effected by means of a glue proper to themselves, which, when it cements, the joining is as hard as the shell, and is as difficultly broken. Sometimes they attach themselves to the rocks by a kind of threads which grow out of their shells.

Oysters usually cast their spawn in May, which at first appears like drops of candle-grease, and sticks to any hard substance it falls upon. These are covered with a shell in two or three days; and in three years the animal is large enough to be brought to market. As they invariably remain in the places where they are laid, and as they grow without any other seem-

ing food than the afflux of sea-water, it is the custom at Colchester, and other parts of England, where the tide settles in marshes on land, to pick up great quantities of small oysters along the shore, which when first gathered, seldom exceed the size of a sixpence. These are deposited in beds where the tide comes in, and in two or three years grow to a tolerable size. They are said to be better tasted for being thus sheltered from the agitations of the deep; and a mixture of fresh water entering into these repositories, is said to improve their flavour, and to encrease their growth and fatness.

The oysters however, which are prepared in this manner, are by no means so large as those found sticking to rocks at the bottom of the sea, usually called rock-oysters. These are sometimes found as broad as a plate, and are admired by some as excellent food. But these are trifling compared to the oysters of the East-Indies, some of whose shells measure two feet over! The oysters found along the coast of Coromandel are capable of furnishing a plentiful meal for eight or ten men; but it seems universally agreed that they are no way comparable to ours for delicacy or flavour.

Thus

Thus the muscle and the oyster appear to have but a few distinctions, except in their shape, and the power of motion in the former. Other bivalved shell-fish, such as the *cockle*, the *scallop*, and the *razor-shell*, have differences equally minute. The power of changing place, which some of them effect in a manner quite peculiar to themselves, makes their greatest difference.

The *scallop* is particularly remarkable for its method of moving forward upon land, or swimming upon the surface of the water. When this animal finds itself deserted by the tide, it makes very remarkable efforts to regain the water, moving towards the sea in a most singular manner. It first gapes with its shell as widely as it can, the edges being often an inch asunder, then it shuts them with a jerk, and by this the whole animal rises five or six inches from the ground. It thus tumbles any way forward, and then renews the operation until it has attained its journey's end. When in the water it is capable of supporting itself upon the surface; and there opening and shutting its shells, it tumbles over and over, and makes its way with some celerity.

The *pivot*, or *razor-shell*, has a very different kind of motion. As the former moves laboriously

ously and slowly forward, so the razor-shell has only a power of sinking point downward. The shells of this animal resemble nothing so much as the haft of a razor; and by this form it is better enabled to dive into the soft sand at the bottom. All the motions of this little animal are confined to sinking or rising downwards or upwards in the sand, for it never leaves the spot where first it was planted. From time to time it is seen to rise about half way out of its hole; but, if any way disturbed, it sinks perpendicularly down again. Just over the place where the razor buries itself, there is a small hole like a chimney, through which the animal breathes, or imbibes the seawater. Upon the desertion of the tide these holes are easily distinguished by the fishermen who seek for them, and their method of enticing the razor up from the depth of its retreat, is by sprinkling a little sea-salt upon the hole; this, melting, no sooner reaches the razor below, than it instantly rises straight upwards, and shews about half its length above the surface. This appearance, however, is instantaneous; and if the fisherman does not seize the opportunity, the razor immediately sinks, and buries itself at its former depth, nor will any salt lure it up again, but there it remains

inains perfectly secure, unless its pursuer will be at the trouble of digging it out of its retreat, which is frequently more than two feet below the surface.

Such are the minute differences between bivalved fish: but in the great outlines of their nature they exactly resemble each other. It is particularly in this class of shell-fish that pearls are found in greatest abundance; they are said, indeed, to be generated in all shells whose insides are of a shining silvery substance, or what is commonly called mother-of-pearl. It has been a matter of dispute whether the pearl originated from accident, or a disease in the animal, and many arguments have been used to support the latter opinion; but these have been so fully answered, as to leave no doubt of the pearl being produced by the same matter that goes to form the inner part of the shell. This substance, which is soft at first, quickly hardens, and thus, by successive coats, layer over layer, the pearl acquires its dimensions. If cut through it will be found to consist of several coats, like an onion; and sometimes a small speck is seen in the middle, upon which the coats were originally formed.

All oysters, and most shell-fish, are found to contain pearls; but that which particularly obtains the name of the pearl oyster, has a large strong whitish shell, wrinkled and rough without, and within smooth and of a silver colour. From these the mother of pearl is taken, which is nothing more than the internal coats of the shell resembling the pearl in colour and consistence.

This however is of very little value, compared with the pearl itself, for the obtaining of which there are several places called pearl fisheries, both in Asia and America; but those of the latter have of late years gone into disuse; and the principal one now in Asia is in the Persian Gulph, near the isle of Bahren; "where," says Goldsmith, "the wretched people that are
" destined to fish for pearls, are either negroes,
" or some of the poorest of the natives of Persia.
" The divers are not only subject to the dangers of the deep, to tempests, to suffocation
" at the bottom, to being devoured by sharks,
" but from their profession universally labour
" under a spitting of blood, occasioned by the
" pressure of air upon their lungs in going down
" to the bottom. The most robust and healthy
" young men are chosen for this employment,
" but

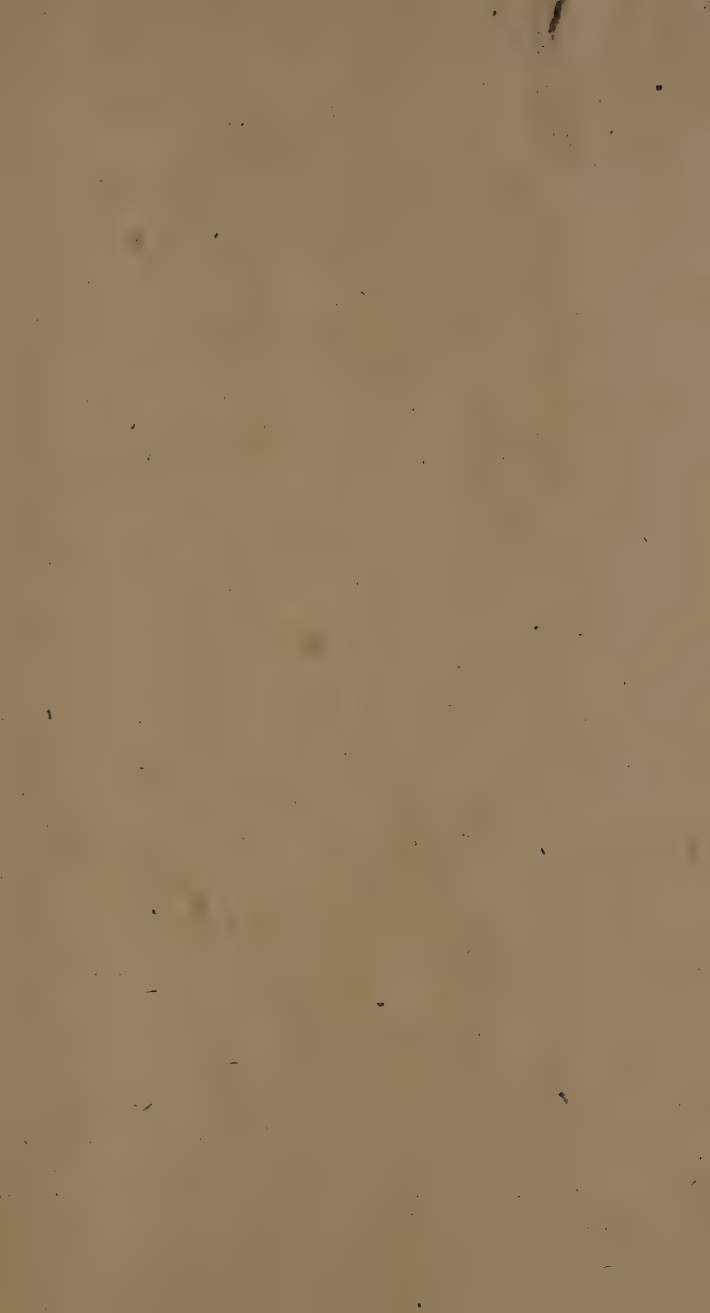
“ but they seldom survive it five or six years.
“ Their fibres become rigid ; their eye-balls
“ turn red ; and they usually die consumptive.
“ It is amazing how long they are seen to
“ continue at the bottom. Some, as we are
“ assured, have been known to continue three
“ quarters of an hour under water without
“ breathing, and to one unused to diving, ten
“ minutes would suffocate the strongest. They
“ fish for pearls, or rather the oysters that con-
“ tain them, in boats twenty-eight feet long ;
“ and of these there are sometimes three or
“ four hundred at a time, with each seven or
“ eight stones, which serve for anchors. There
“ are from five to eight divers belonging to each,
“ that dive one after another. They are quite
“ naked, except that they have a net hanging
“ down from the neck to put their oysters in,
“ and gloves on their hands to defend them
“ while they pick the oysters from the holes in
“ the rocks ; for in this manner alone can they
“ be gathered. Every diver is sunk by means
“ of a stone, weighing fifty pounds, tied to the
“ rope by which he descends. He places his
“ foot in a kind of stirrup, and laying hold of
“ the rope with his left hand, with his right he
“ stops his nose to keep in his breath, as in
VOL. IV. T t “ going

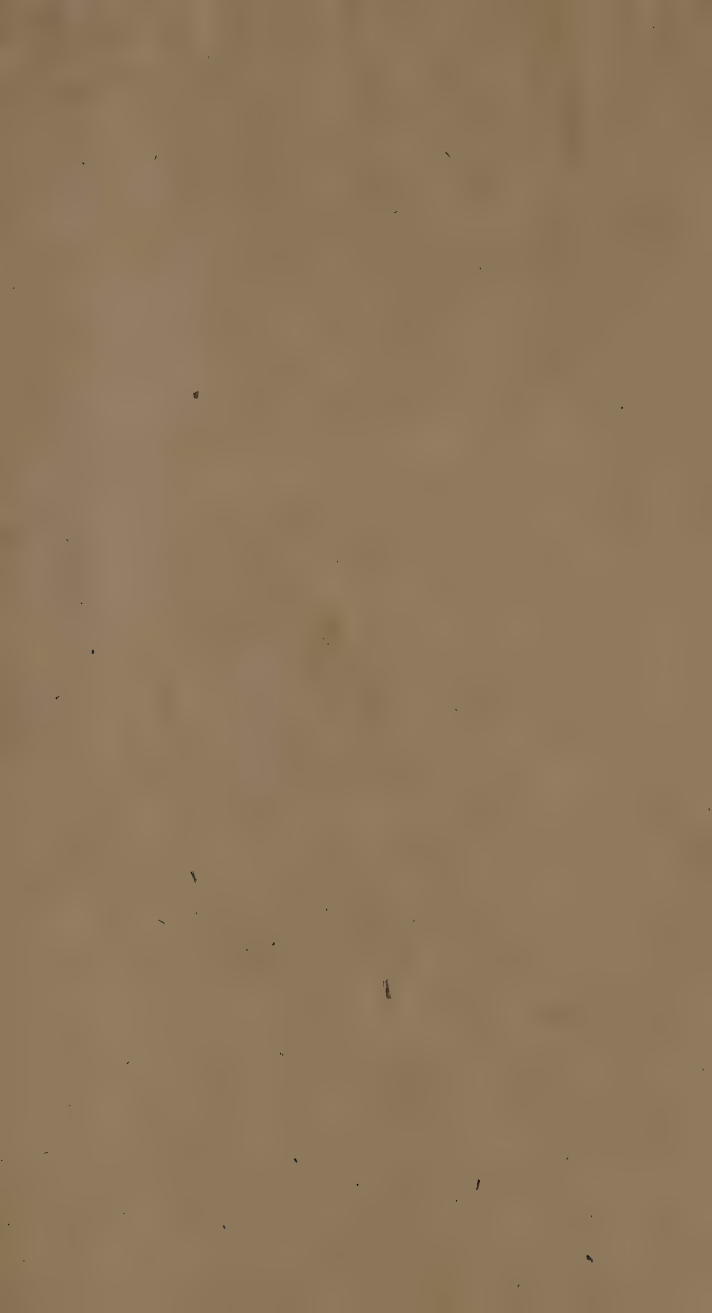
“ going down he takes in a very long inspiration. When at the bottom, they give a signal to those in the boat to draw up the stone ; which done, they go to work, filling their net as fast as they can ; and then giving another signal, the boats above pull up the net loaded with oysters, and shortly after the diver himself, to take a new inspiration. All the oysters are brought on shore, where they are laid in a great heap till the pearl fishery is over, which continues during the months of November and December.”

The fishing-season being over, they then examine every oyster for the pearls, but they are not always alike successful, for some seasons turn out infinitely more advantageous than others, not entirely arising from the numbers they obtain, but from their value, which increases not only in proportion to their size, but also in their figure and colour ; some are found of an oblong, others nearly round ; some are white, others have a yellowish shade, others are of a lead colour, and some are met with, though very rarely, as black as jet.

END OF THE FOURTH VOLUME.

Squire, Printer, Furnival's Inn Court.





46

